GCE EXAMINERS' REPORTS

MATHEMATICS
AS/Advanced

JANUARY 2010

Statistical Information

This booklet contains summary details for each unit: number entered; maximum mark available; mean mark achieved; grade ranges. *N.B. These refer to 'raw marks' used in the initial assessment, rather than to the uniform marks reported when results are issued.*

Annual Statistical Report

The annual *Statistical Report* (issued in the second half of the Autumn Term) gives overall outcomes of all examinations administered by WJEC.

MATHEMATICS

General Certificate of Education

January 2010

Advanced Subsidiary/Advanced

Principal Examiner: Dr. E. Read

Unit Statistics

The following statistics include all candidates entered for the unit, whether or not they 'cashed in' for an award. The attention of centres is drawn to the fact that the statistics listed should be viewed strictly within the context of this unit and that differences will undoubtedly occur between one year and the next and also between subjects in the same year.

Unit	Entry	Max Mark	Mean Mark
C1	2736	75	44.8

Grade Ranges

A	57
B	49
C	41
D	34
E	27

N.B. The marks given above are raw marks and not uniform marks.

C1

General Comments

Performance generally seemed to be on a par with that of previous years but this year's paper probably turned out to be a little more difficult than the corresponding paper last year. The questions which seemed to cause most problems were questions 3, 6(*b*) and 10(*c*).

Q.1 The coordinate geometry question is always well answered and this was no exception with many candidates managing to get full marks.

Q.2 Part (a) caused very few problems but in part (*b*), not all candidates were able to simplify $\frac{22}{\sqrt{2}}$ while others had difficulty with $\left(\sqrt{2}\right)^5$.

Q.3 Some of the differentiation at the beginning of the question was poor and many candidates also made errors when substituting 2 for x in their expression for $\frac{dy}{dx}$

Q.4 Both parts were generally well answered.

Q.5 In part (a), most candidates were able to write down an expression for the discriminant in terms of k, but surprisingly many were unable to proceed from $9 + 20k < 0$ to give the correct range for k. As is usually the case, part (*b*) seemed to cause few problems.

Q.6 The proof from first principles was well answered but many candidates still lose the final mark because of the use of incorrect mathematical notation. In part (*b*), some candidates were unable to enumerate $4^{3/2}$ correctly while others substituted 4 for x in the expression for y and then tried to differentiate a constant as if it was an expression in x.

Q.7 Although most candidates were able to write down the relevant terms of the binomial expansion, not all were then able to express the information given in the question in the form of a correct equation. A common error was to write down an equation involving x and x^2 rather than just the corresponding coefficients.

Q.8 This question was well answered as is always the case although there were some interesting (incorrect) answers given in (*a*)(ii).

Q.9 Although the format of part (*b*) was slightly different to what candidates were used to, many were able to get full marks on this question.

Q.10. In part (a), the absence of a constant term in the expression for $\frac{dy}{dx}$ led to some errors in the derivation of the x-coordinates of the stationary points.
Some candidates tried to use a 'discriminant' method in part (c), even though they were dealing with a cubic equation.

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Unit	Entry	Max Mark	Mean Mark
C2	1060	75	43.7

Grade Ranges

A	54
B	47
C	41
D	35
E	29

N.B. The marks given above are raw marks and not uniform marks.

C2

General Comments

Performance on this year's paper was probably a little better than that on the corresponding paper last year. However, basic concerns involving simple algebraic manipulation, premature approximation and lack of understanding of some of the standard basic proofs still remain.

Q.1 Generally well answered with few errors of computation.

Q.2 Part (a) was well answered. In part (b), some candidates who were able to do the trigonometry correctly lost marks because of poor algebra. Others omitted 395° as a possible value for $2x + 45°$ and consequently lost one of the solutions of the equation. Most of those candidates who realised that they had to use the fact that $\tan\,\theta = \dfrac{\sin\theta}{\cos\theta}$ were able to get full marks in part (c).

Q.3 In part (a), most candidates were able to use the cosine rule correctly to derive an equation in x but poor algebraic manipulation again often led to incorrect solutions. Part (b) was generally well answered.

Q.4 Most candidates found both parts of this question to be relatively straightforward.

Q.5 Part (a) was well answered. In part (b), most candidates successfully eliminated a but relatively few realised that the question would become very difficult to solve unless they also divided throughout by $(1 – r)$. It was also very disappointing to see some candidates who had done all the hard work to reach $r^4 = 0{\cdot}4096$ then rounding off to $r^4 = 0{\cdot}41$ before trying to find their value for r.

Q.6 Both parts of this question were well answered.

Q.7 As is always the case, many of the proofs in part (a) were far from convincing. On the other hand, most candidates were able to get full marks on part (b). In part (c)(i), very few candidates were able to rewrite the equation in the required form and consequently most candidates tried to use the 'otherwise' method to solve the equation in (c)(ii). Unfortunately, incorrect algebraic manipulation again led to incorrect solutions.

Q.8 Part (a) caused few problems. In part (b), many candidates derived a correct quadratic but then did not know what to do with it.

Q.9 Candidates found parts (a) and (b) to be relatively straightforward but many were unable to derive a correct equation for ϕ in part (c).

Q.10 Although this type of question had not appeared recently, many candidates were able to answer both parts correctly.

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Unit	Entry	Max Mark	Mean Mark
C3	2036	75	53.3

Grade Ranges

A	61
B	53
C	45
D	37
E	29

N.B. The marks given above are raw marks and not uniform marks.

C3

General Comments

Candidates found this to be a very accessible paper and generally performance was good. It seemed to be the final three questions which caused candidates most problems and the overall standard of graph sketching could certainly have been better.

Q.1 As usual, this was a well answered question.

Q.2 In part (a), not all candidates were able to work out both sides of the identity correctly for their given choice of θ. Part (b) seemed to cause very few problems.

Q.3 Part (a) was well answered. In both parts of (b), surprisingly many candidates lost marks through incorrect cancelling while others thought that they could get an expression for $\frac{d^2y}{dx^2}$ simply by differentiating the first derivative with respect to *t*.

Q.4 Most of the errors which occurred here arose as a result of candidates having their calculators in the wrong mode. Some candidates answered the first part in radians and then switched to degrees for the rest of the question.

Q.5 It was only part (a) which caused any real problems here. Some candidates were not able to apply the quotient rule correctly while others made errors while trying to simplify the final result.

Q.6 Part (a) was well answered but in part (b), it was not uncommon to see candidates omitting the minus sign when integrating the sine function.

Q.7 In part (a), most candidates were able to rewrite the equation as $|x + 1| = 5$. Not all were then, however, able to deduce both correct vales for *x*. In part (b), some candidates did not combine their inequalities to express the required range for *x* in a correct mathematical form.

Q.8 The general standard of the graphs drawn left much room for improvement. In particular, many candidates' attempts at indicating asymptotic behaviour was poor while others did not realise that the second graph eventually became steeper than the first as *x* increased.

Q.9 Most candidates were able to answer part (a) successfully but again the graph sketching in part (b) caused problems. Some candidates took no account of the domain and range of f^{-1} which they had found in part (a) when drawing their graph.

Q.10 It was part (b) which caused most problems in this question and only a few candidates were able to explain correctly why *gf* (1) could not be formed. Some candidates lost marks by giving the domains and ranges as closed rather than open intervals.

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Advanced Subsidiary/Advanced

Principal Examiner: Dr. S. Barham

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Unit	Entry	Max Mark	Mean Mark
M1	729	75	46.8

Grade Ranges

A	58
B	49
C	41
D	33
E	25

N.B. The marks given above are raw marks and not uniform marks.

M1

General Comments

This paper was of a suitable standard and length and was comparable with previous papers on this syllabus. All questions were accessible though question 9(b) was less well answered than the rest of the paper.

Q.1 Part (a) was well done generally. Part (b) was surprisingly badly done as many candidates only found the time taken to reach the greatest height rather than the time taken to return to the initial point. Part (c) was well done generally though many candidates lost the last mark by failing to state the direction of motion of the particle as requested by the question.

Q.2 There were a great many candidates who made a sign error in part (a) though part (b) was very well done with almost all candidates getting full marks there.

Q.3 Many candidates were able to obtain the two equations by applying Newton's Second Law to the particles separately. There were many arithmetic/algebraic errors in the subsequent attempts to solve the equations simultaneously.

Q.4 Many sensible attempts to resolve the forces in two directions to obtain two simultaneous equations were seen but correct solutions to those equations were not as common as I would have liked.

Q.5 The *v*-*t* graph in part (a) was very well done generally in spite of the variable T involved in the time axis. The concept required in part (b) was well known and understood but candidates were let down badly by their inability to calculate the area of a trapezium. Some candidates lost the mark in the question by omitting to find the total time after finding the value of T.

Q.6 Part (a) was well done generally. In part (b), the concept of limiting friction did not seem to be well understood. It was disappointing to be told many times that friction exceeds the horizontal force. Most candidates realise that the particle remains stationary though some candidates thought that friction itself was capable of moving objects.

Q.7 This question was well done as usual. Some sign errors arose from the fact that the particles were moving in opposite directions initially so that the initial velocities had opposite signs.

Q.8 Many candidates missed the obvious point (X) about which to take moments for a neat solution to the problem. Candidates who took moments about either end of the rod typically forgot the tension in the string. Many candidates also forgot the weight of the rod altogether.

Q.9 Part (a) was well done generally with the common errors being made in finding the centre of mass of the triangle or the centre of mass of the square with reference to point A as origin. The response to part (b) was extremely disappointing with the majority of candidates not being able to make a sensible attempt. Correct solutions were few and far between. A vast variety of unsuitable methods were seen.

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Unit	Entry	Max Mark	Mean Mark
S1	810	75	45.6

Grade Ranges

A	56
B	48
C	40
D	32
E	25

N.B. The marks given above are raw marks and not uniform marks.

General Comments

The standard of the candidature was generally satisfactory although questions involving the probability density functions of continuous random variables continue to cause problems for many candidates.

Q1 This question was well answered by most candidates, although in (c) some candidates wrote, incorrectly, that the probability of choosing no green sweets is 1 – the probability of choosing 2 green sweets, forgetting that there is also the possibility of choosing 1 green sweet.

Q2 Most candidates realised that the best way of showing independence was to show that $P(A \cap B) = P(A)P(B)$ but the mathematics required to prove this result was often poorly expressed. In (b), some candidates showed that the probabilities of only *A* occurring and only *B* occurring were 0.32 and 0.12 but failed to add these numbers. Solutions to (c) were often disappointing with the conditional probability formula used incorrectly.

Q3 Most candidates obtained the simultaneous equations for *n* and *p* but some were unable to solve these equations. In (b), the mean was chosen to be 6.08 so that candidates would have to use the Poisson formula and not the tables to find the required probability. Candidates should be aware that if a question contains a parameter which is not in the tables, they should not interpolate or approximate using tables and no credit will be given if they do.

Q4 In (a), some candidates thought that λ could only take the values 0, 0.1, 0.2, 0.3 and 0.4, not realising that it could take any value between 0 and 0.4.
Part (b) was well done in general although some candidates thought that Var(*X*) = $\mathrm{E}(X^2)$.

Q5 Part (a) was well done in general with most candidates able to convert correctly from B(20, 0.8) to B(20, 0.2). In (b), candidates who obtained the correct answer using trial and error were given full credit.

Q6 This question was reasonably well done with those candidates who drew a tree diagram generally more successful than those who did not.

Q7 Part (a) was well done but (b) caused problems for some candidates who thought that the answer was the same as (a)(i), not realising that a conditional probability was now required.

Q8 Solutions to the question on continuous distributions continue to cause problems for some candidates. In (a)(ii), many candidates derived the correct quadratic equation for the median but, as often the case, used a variety of incorrect methods to solve it. Many candidates were unable to find the expression for *f*(*x*) with many attempts seen involving the integration of *F*(*x*). In (b)(ii), it was disappointing to note that the majority of candidates gave a non-zero answer, often after a lengthy calculation – the instruction ‘write down’ should have indicated that no calculation was necessary.

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Unit	Entry	Max Mark	Mean Mark
FP1	240	75	46.4

Grade Ranges

A	57
B	49
C	41
D	34
E	27

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Paper FP1

General Comments

The standard of the scripts was generally good with some excellent candidates but also some who were clearly not suitably prepared for an examination at this level. Solutions to questions on mathematical induction continue to be generally poor.

Q1 This question was well answered in general. Some candidates spotted that (x + 2) is a factor and therefore that $(x^2 - 2x + 5)$ is the other factor which gives the three roots of the equation. Although this was not the method intended, it was given full credit.

Q2 Some candidates seemed to find dealing with 2 × 2 matrices difficult, so much so that a few even converted **A** to a 3 × 3 matrix by the transformation

$$\begin{bmatrix} 7 & 5 \\ 3 & 2 \end{bmatrix} \to \begin{bmatrix} 7 & 5 & 0 \\ 3 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix},$$

then found the inverse of this 3 × 3 matrix and then just took the top left-hand corner which gives the correct answer and was therefore accepted.

Q3 Most candidates found z correctly. Some candidates, however, gave the argument in the 4^{th} quadrant instead of the 2^{nd}. It is important for candidates to realise that the argument of a complex number is not necessarily $\tan^{-1}(y/x)$ - the signs of x and y have to be examined to determine the correct quadrant.

Q4 This question was well answered in general. The most common source of error was in the calculation of linear combinations of the rows.

Q5 In general, the candidates found this question difficult. Some candidates, noting that the equation had three terms, tried to use '$b^2 = 4ac$' as the condition for equal roots. Even candidates who took the roots to be α,α,β often found the subsequent algebra too difficult. Candidates who tried the alternative method of noting that $f(x)$ and $f'(x)$ had a common root also found the algebra beyond them in many cases.

Q6 In general, the presentation of solutions to the induction question were again poor. The expectation is that candidates will write something like 'Assume the result is true for $n = k$' and 'Consider for $n = k + 1$'. All too often, all that is seen is 'Let $n = k$' and 'Let $n = k + 1$'. In many solutions, the Σ signs are omitted so that what is written is 'Assume $k \times k! = (k + 1)! - 1$ which is meaningless. Solutions to (b) were generally good.

Q7 Most candidates realised that the first step was to take logs. The differentiation of lncosec$x$, however, caused problems for some candidates who gave the incorrect answer 1/cosec$x$, not realising that this had to be multiplied by the derivative of cosec$x$. Solutions to (b) were generally disappointing with many candidates, possibly even the majority, using their calculators in degree mode instead of radian mode. Candidates need to be aware of the need to consider which mode is relevant to a particular situation. Some candidates stopped at the first iteration instead of continuing until a limit is found.

Q8 Questions on this topic are generally well answered and this was no exception. In (b), some candidates in attempting to find the coordinates of the fixed point simply showed that $x - 1 = x$ and $-y - 1 = y$ and then wrote 'Therefore no fixed points'. This was not sufficient for full credit – candidates had to explain why these equations are not consistent. Some candidates were unable to carry out the necessary elimination in (c).

Q9 This question was generally well answered.

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