WJEC
CBAC

GCE EXAMINERS' REPORTS

MATHEMATICS
AS/Advanced

JANUARY 2012

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 2012

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	3205	75	50.1

Grade Ranges

A	61
B	53
C	46
D	39
E	32

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

C1

General Comments

Candidates seemed to find this to be an accessible paper and performance was in general better than last year. It was only questions 4(*b*), 7(*b*) and 10(*b*) which caused any problems.

Q.1 This question was well answered, as is always the case. However, in (*a*)(i), after having considered the gradients of *AB* and *CD*, not all candidates were then able to give an explicit reason why these lines should be parallel.

Q.2 Neither part caused any real problems.

Q.3 The majority of candidates got full marks on this question.

Q.4 In part (*a*), almost all candidates knew the correct form of the binomial expansion but many were then unable to carry out the correct numerical and algebraic simplification of the individual terms. Questions like part (*b*), where the index is unknown, always cause problems, and many candidates failed to get any marks because they did not take into account the fact that the coefficient x was 2 and not 1.

Q.5 As is usually the case, there were many computational errors in part (*a*) and not all candidates knew how to use their answer to part (*a*) to derive the greatest value of the given expression in part (*b*).

Q.6 Generally well answered although finding the required range for k seemed to cause more problems than usual.

Q.7 In the proof from first principles, some candidates still lose marks because of the use of poor or incorrect notation. Part (*b*) was at best patchily answered. Some candidates did not differentiate at all while others substituted 4 for x before differentiating. What was particularly disappointing was that several candidates, having shown that

$$-\frac{a}{16} + \frac{5}{2} = 3,$$

were then unable to proceed to show that $a = -8$.

Q.8 Part (*a*) caused very few problems. However, in part (*b*), the fact that there was no x^2 term meant that some candidates failed to get any further than showing that $(x + 2)$ was a factor of the given cubic expression.

Q.9 Part (*a*) was well answered and in part (*b*), the majority of candidates knew how to interpret their graph to find the number of real roots of $f(x) - 5 = 0$.

Q.10 Most candidates got full marks on part (*a*). Part (*b*) was slightly better answered than was the case the last time a similar question was set but there are still many candidates who think that $\frac{d^2y}{dx^2} = 0$ is a sufficient condition for a point of inflection.

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Unit	Entry	Max Mark	Mean Mark
C2	1117	75	47.8

Grade Ranges

A	58
B	50
C	43
D	36
E	29

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

C2

General Comments

Candidates probably found this year's paper a little less accessible than last year's. There were several parts to questions which caused some difficulty and these are noted in the individual questions below.

Q.1 Well answered, as is usually the case.

Q.2 There were very few problems in part (*a*) but in part (*b*) some candidates failed to get the root $x = 7°$. The reasons given in part (*c*) to explain why $\cos \phi + \sin \phi = 3$ has no roots were many and varied and unfortunately, mostly incorrect.

Q.3 Parts (*a*) and (*b*) were well answered but some candidates still do not know the correct form of the cosine rule. In part (*c*), comparatively few candidates spotted the fact that the area of the triangle could be used to find the length of *AD*.

Q.4 This question seemed to cause very few problems.

Q.5 Both parts were well answered. In particular, in part (*b*), candidates seemed to have fewer problems than usual in setting up and solving a correct equation for *r*.

Q.6 The only general problem which arose here was in part (*b*), where some candidates did not know how to deal with the negative value for the area below the *x*-axis. Others thought that it could be calculated as the area of a triangle.

Q.7 In part (*c*), most candidates were able to earn the first three marks by correctly applying the appropriate results on the rules of logarithmic manipulation but only a minority realised the significance of the fact that the logarithms were to base 9 when trying to solve part (ii).

Q.8 Part (*a*) was generally well answered although some candidates ended up with a straight line when trying to find the equation of *C*. Only a minority were able to find the required angle in part (*c*) and not all of these candidates used the fact that *PQR* was a right angled triangle

Q.9 Many candidates were able to get full marks on this question but not all candidates correctly interpreted the information given in part (*b*).

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Unit	Entry	Max Mark	Mean Mark
C3	2356	75	52.7

Grade Ranges

A	60
B	52
C	44
D	37
E	30

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

C3

General Comments

The mean mark was slightly lower than last year's mark but most of this was due to the fact that hardly any of the candidates managed to earn the final two marks on question 1. Most of the other marks which were lost came from 7(*b*), 8(*b*)(iii) and the final two questions on the paper.

Q.1 Part (*a*) was very well answered but only a handful of candidates realised that in part (*b*), it was necessary to evaluate

$$\int_0^{\pi/3} 1\,dx - \int_0^{\pi/3} \cos^2 x\,dx$$

Q.2 There were very few problems here, in either part (*a*) or part (*b*).

Q.3 This was another well answered question with many candidates getting full marks.

Q.4 Almost all candidates found an expression for $\frac{dy}{dx}$ and then substituted in this expression rather than substituting immediately after differentiating and then collecting like terms. Algebraic manipulation was, however, generally good.

Q.5 It was only the differentiation of e^{x^3} in part (*b*) which caused any problems here.

Q.6 All parts were generally well answered.

Q.7 Whereas most candidates were able to answer part (*a*) correctly, a common error in part (*b*) was to evaluate the right hand side as $4^{1/3}$ rather than 4^3.

Q.8 Although some of the graph sketching was poor, it was (*b*)(iii) which caused most problems, with many candidates thinking that $f(3x) - 4$ was $3e^x - 4$.

Q.9 Although some candidates got full marks on this question, some of the algebra involved in finding an expression for $f^{-1}(x)$ was poor.

Q.10 In part (*a*), some candidates wrote down the range of *f* as $[3 + k, \infty + k)$. In part (*b*), not all candidates realised that the necessary condition required was the fact that the range of *f* had to be contained in the domain of *g*.

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Principal Examiner: Dr. S. Barham

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Unit	Entry	Max Mark	Mean Mark
M1	918	75	52.5

Grade Ranges

A	61
B	53
C	46
D	39
E	32

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

M1

General Comments

This paper is a little easier than previous papers on this syllabus. The majority of candidates were well able to make some attempt at all of the questions. There were many scripts of excellent quality, demonstrating a firm grasp of the subject by the candidates. It is pleasing to note some general improvement in the answers to the question on equilibrium under parallel forces (moments), although the question is an easy one of its type. There is a reduction in the number of scripts obtaining less than 25 marks. On the whole, marking this paper had been a pleasurable experience.

Q1. Parts (a) and (b) were well answered generally though the quality of some of the *v-t* graph sketches left something to be desired. Part (c) was badly done by many candidates and numerous candidates thought 24 km makes 2400 m instead of the correct 24000 m. The standard of presentation on this part question was particularly bad.

Q2. This was a particularly well done question with far fewer sign errors than expected. Numerous candidates gained full marks here.

Q3. Part (a) did not posed any problems for most candidates. Part (b) contained less structure than questions of this type in previous papers. It being a two step problem, many candidates were not able to correctly calculate the intermediate value required, which is the velocity of the particle immediately after rebound. Many candidates used their answer in part(a) which is inappropriate. Very few candidates were entirely successful in gaining full marks.

Q4. This is a very standard question on Newton's Experimental Law and generally candidates made satisfactory attempts at a solution. It is disappointing to see many candidates who made arithmetic or algebraic mistakes, consequently obtaining impossible answers failing to realise this and return to check their working.

Q5. This was a well known question which had been set many times in previous papers and there were no real surprises either for the candidates or for the examiners. The standard of presentation on this question was particularly poor generally.

Q6. The commonest error in part (a) was made when applying N2L to the particle moving horizontally on the table. Candidates often thought gravity had an effect by including the weight of the particle in the equation of motion. Part (b) proved too difficult for most candidates who failed to see that all the equations in part (a) also allied with the acceleration equal to zero. In addition, many candidates thought the tension obtained in part (a), when the particles were moving, still applied when the particle was stationery.

Q7. A general improvement in the solution to this question was noted, although this question is an easy one. There were many more candidates than usual who obtained full marks. Mistakes were often algebraic, made in calculating the various distances required involving the unknown *x*.

Q8. This question was well done as usual and proved to be a life saver for many weak candidates. A few candidates made errors in calculating the area of the circle and some added the circle instead of subtracting it. Candidates dealt with the awkward numbers without difficulties. However, a surprising number of candidates were not able to do part (c).

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Principal Examiner: Dr. J. Reynolds

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Unit	Entry	Max Mark	Mean Mark
S1	835	75	52.3

Grade Ranges

A	62
B	54
C	46
D	38
E	31

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

S1

General Comments

The candidature covered the whole ability range with many candidates submitting excellent scripts but others quite unprepared to take an examination at this level. The question on continuous probability distributions, involving calculus, continues to cause problems for many candidates.

Q.1 This questions was well answered in general.

Q.2 Most candidates found the mean of *X* correctly but incorrect expressions for the variance were seen, including $2 \times \text{Var}(X)$ and $4 \times \text{Var}(X) + 3$.

Q.3 Part (a)(i) was well answered in general. In (a)(ii), although most candidates realised that because $p > 0.5$ they had to switch to the distribution of X', the number of times Ben wins, some were unable to go from $X \geq 6$ to $X' \leq 4$.

Q.4 In (a), some candidates assumed that *A* and *B* were independent without realising that $P(A) = 0.4$ and $P(A \mid B) = 0.3$ indicates that this is not the case. For these candidates, follow through was allowed in (b) but not in (c) since application of the appropriate formula simply led to the conclusion that $P(B \mid A) = P(B)$ which is incorrect.

Q.5 This question was well answered by many candidates, with tree diagrams proving to be a successful method of solving this type of problem.

Q.6 Part (a) was well answered by many candidates. In (b), however, it was not uncommon to see an incorrect number obtained from tables, usually one from a row or column adjacent to the correct one.

Q.7 This question was well answered by many candidates. It was encouraging to see so many correct evaluations of $E\left(\frac{1}{X}\right)$; this is a topic that has not been well answered on previous occasions.

Q8 Most candidates wrote down the equation $16pq = 2.56$ leading to $pq = 0.16$. Some candidates spotted that $p = 0.2$, $q = 0.8$ satisfied this equation, others replaced *q* by $1 - p$ and solved the resulting quadratic equation in *p* while some candidates were unable to make any further progress. In (b), it was disappointing to see some candidates stating, incorrectly, that $E(X^2) = (E(X))^2$.

Q.9 As in previous examinations, some candidates found it difficult to apply calculus to problems involving continuous probability distributions although, overall, the responses to this question showed some improvement. In (a)(i), some candidates, incorrectly, used integration to find k. In (b)(i), some candidates used integration instead of differentiation to find the probability density function. Some of the candidates who attempted to differentiate $F(x)$ did it incorrectly. In (b)(ii), some candidates obtained values for $E(X)$ outside the interval [1,3] without any apparent concern. In this situation, candidates should check their work to find the error in the calculation.

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Unit	Entry	Max Mark	Mean Mark
FP1	346	75	48.6

Grade Ranges

A	59
B	51
C	43
D	35
E	28

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

FP1

General Comments

The candidates were well prepared in general with few poor scripts seen. Solutions to the question on mathematical induction remain poor overall with many candidates apparently not understanding that the crux of the method is to assume that the result is true for $n = k$ and to show that this leads to the result being true for $n = k + 1$.

Q.1 The correct solution involved the simplification of $1-x-(1-x-h)$. It was disappointing to note that a significant minority of candidates simplified this, incorrectly, to $-h$. This led to the incorrect final answer $-\frac{1}{(1-x)^2}$ which should have been recognised as incorrect. In these problems requiring differentiation from first principles, the candidates should know the correct answer and should check their work if a different answer is obtained.

Q.2 This question was well answered by the majority of candidates with no commonly occurring error noted.

Q.3 Some candidates let the roots be α and β without ever putting $\beta = 2\alpha$. Others let the roots be α, 2α and β, thinking that the quadratic equation had three roots. In either case, no significant progress could be made. In (b), candidates were expected to show that $b^2 - 4ac = \frac{b^2}{9} > 0$ although some candidates showed that $\alpha = -\frac{b}{3a}$ which is real and this was given full credit.

Q.4 In (b)(ii), almost every candidate realised immediately that 2 – 3i was a root but a variety of methods, some fairly long, was used to locate the third root. The intended method used the fact that the sum of the roots is zero but other successful methods seen included long division and even trial and error.

Q.5 In (a), most candidates showed, correctly, that the determinant was equal to $k^2 - 4k + 5$ but some were unable to show that this is never zero for real k. The expected solution involved completing the square although many candidates showed that '$b^2 - 4ac$'< 0 and this, of course, was accepted. In (b), the arithmetic involved in finding adj(**A**) and the inverse of **A** was generally well done. In (iii), candidates were required to use $\mathbf{A}^{-1}$ to solve the equations and other methods were not accepted.

Q.6 The presentation of proof by induction continues to be generally poor. Many candidates write 'Let $n = k$' when they mean 'Assume that the proposition is true for $n = k$'. Then, at the end, many write 'True for $n = 1$, true for $n = k$ and true for $n = k + 1$ therefore proved by induction'. Full credit is only given for stating that true for $n = k$ implies true for $n = k + 1$.

Q.7 Questions on this topic are generally well done and this was no exception. In (b)(ii), candidates who started with the parametric form of the line, ie $(\lambda, 3\lambda + 1)$ were generally more successful than those who let $(x, y) \to (x', y')$, where there was sometimes confusion between the two sets of coordinates.

Q.8 Many candidates found the equation of the locus of P correctly. In attempting to find the radius and the coordinates of the centre, candidates who tried to complete the square of the equation in the form $3x^2 + 3y^2 + 10y + 3 = 0$ were often unsuccessful, the process being much simpler when the coefficients of x^2 and y^2 are 1. Very few candidates used the standard results that, in the usual notation, the coordinates of the centre are $(-g, -f)$ and the radius is $\sqrt{g^2 + f^2 - c}$.

Q.9 Parts (a) and (b) were generally well answered. In (c), candidates were expected to differentiate the equation $f'(x) = f(x)g(x)$ as it stood. Candidates who replaced $f(x)$ and $g(x)$ by their expressions often made algebraic errors but if successful were given full credit. Several successful methods were seen in establishing the nature of the stationary point, including the consideration of the values of $f(x)$, $f'(x)$ or $f''(x)$ for appropriate values of x.

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