GCE EXAMINERS' REPORTS

MATHEMATICS
AS/Advanced

JANUARY 2013

Statistical Information

The Examiner's Report may refer in general terms to statistical outcomes. Statistical information on candidates' performances in all examination components (whether internally or externally assessed) is provided 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 2013

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	3358	75	49.1

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 very similar to that on last year's paper. It was only questions 7 and 10(*c*) which caused any real problems.

Q.1 This question was generally well answered but in part (*b*), not all candidates were able to extract the gradient of *L* from its given equation and then give an explicit reason why *AB* and *L* should be perpendicular.

Q.2 Neither part caused any real problems.

Q.3 Another well answered question, as is always the case.

Q.4 The only problem which arose in this question involved the final mark. Very few candidates were able to interpret their values for *x* and *y* as the coordinates of the points of intersection of a straight line and a curve.

Q.5 In part (*a*), after having shown that $k > -{}^3/_5$, several candidates lost the final mark by giving their range as ${}^3/_5 > k > -{}^3/_5$ or $0 > k > -{}^3/_5$.

Q.6 Despite the fact that the coefficient of x^2 was – 1, many candidates were able to gain full marks for part (*a*). In particular, there was a distinct improvement in the consistent use of correct notation throughout this part of the question.

Q.7 This was the question which caused candidates most problems. Many forgot to square the 4 in the coefficient of x^2 while only a minority of candidates were able to write down a correct equation involving the coefficients without including any powers of *x*.

Q.8 Almost all candidates were able to earn both marks in part (*a*). In part (*b*), some candidates used the Factor Theorem to show that $(x + 2)$ was a factor of the cubic expression even though this information had already been given in the question. The fact that there was no *x* term in the quadratic factor caused very few problems.

Q.9 Part (*a*) was well answered but in part (*b*), some candidates drew the graph of $y = -f(x)$ rather than that of $y = f(-x)$.

Q.10 Parts (*a*) and (*b*) caused very few problems but very few candidates had any idea of how to go about earning the final two marks.

MATHEMATICS

General Certificate of Education

January 2013

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
C2	1207	75	47.9

Grade Ranges

A	59
B	51
C	44
D	38
E	32

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

C2

General Comments

Performance on this year's paper was similar to last year's. The questions with which candidates had most difficulty were 4(*a*)(ii), 5(*a*) and 6(*b*)(ii) while there were many complete solutions to question 8.

Q.1 Almost all candidates got full marks on this question, as is always the case.

Q.2 Part (*a*) was well answered but in part (*b*) some of the algebra was poor.

Q.3 This year's question seemed to cause fewer problems than is usually the case on the trigonometry question.

Q.4 Answers to (*a*)(ii) were particularly disappointing with most candidates being unable to apply the method employed in the general proof to the particular case required here..

Q.5 Some candidates treated this question as if it were an A.P. rather than a G.P. In part (*a*), only a minority of candidates realised that they could write down the common ratio from the given values of successive terms. On the other hand, there were many complete solutions to part (*b*).

Q.6 It was (*b*)(ii) which candidates found most difficult and many failed to realise that it could only be done by differentiating the equation of the curve. The remainder of the question was well answered.

Q.7 Neither part caused any real problems. In particular, the proofs in part (*a*) seemed to be better structured than has been the case in recent examinations.

Q.8. All parts of this question were well answered.

Q.9 Although there were many correct solutions, part (*b*) was disappointing with many candidates being unable to express the given information in the form of an equation.

MATHEMATICS

General Certificate of Education

January 2013

Advanced Subsidiary/Advanced

Principal Examiner:

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**
C3	2558	75	53.8

Grade Ranges

A	62
B	54
C	46
D	39
E	32

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

C3

General Comments

The mean mark was slightly higher than last year's mark. Candidates found most questions to be accessible and it was only on 3(*b*)(ii) and 9(*b*) that solutions turned out to be generally disappointing.

Q.1 This question was universally very well answered.

Q.2 There were very few problems here and most candidates realised that the solution to (*a*)(ii) was either $\theta = 0°$ or $\theta = 90°$.

Q.3 Whereas most candidates were able to pick up the first 8 marks, solutions to (*b*)(ii) were particularly disappointing with many candidates failing to differentiate their expression for $\frac{dy}{dx}$ correctly. In (*b*)(iii), many failed to realise that the first step involved finding the value of t for which $x = 3$.

Q.4 In part (*a*), the graphs were generally correct although the asymptotic behaviour of $y = \ln x$ was sometimes poor. In part (*b*), the fact that the fifth digit after the decimal point was 0 caused some difficulty and many candidates were unable to prove that their value was the value of α correct to 5 decimal places.

Q.5 Candidates had few problems in part (*a*) but many were unable to make any progress in part (*b*).

Q.6 It was only the final mark in part (*b*) which caused candidates any problems with many being unable to carry out the correct logarithmic manipulation required.

Q.7 Both parts of this question were well answered.

Q.8 This was another well answered question with many candidates earning full marks.

Q.9 In part (*a*), very few candidates realised that the lower limit for the range of fg was -25. In part (*b*), many were able to write down a correct expression for $hh(x)$ but only a minority were then able to carry out the correct algebraic manipulation required to show that $hh(x) = x$. Only a handful of candidates realised that the fact that $hh(x) = x$ meant that $h^{-1}(x) = h(x)$.

MATHEMATICS

General Certificate of Education

January 2013

Advanced Subsidiary/Advanced

Principal Examiner: Dr. S. Barham

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
M1	1047	75	52.4

Grade Ranges

A	62
B	54
C	46
D	39
E	32

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

M1

General Comments

This paper was of an appropriate standard for this syllabus and was generally well received by most candidates. There was no evidence that candidates found it too long as almost all candidates managed to attempt all of the questions. All the questions were assessable though some candidates had problems with Q2 which is on Newton's experimental Law; a question which had been usually well done in previous years.

There were a large number of perfect or near perfect scripts, with candidates losing one or two marks on the questions that tested the understanding of the mechanical concepts.

Q1. Parts (a) and (b) were extremely well done with almost the entire candidature gaining full marks. In part (c), some candidates halved the time instead of halving the required distance.

Q2. Part (a)(i) proved too difficult for many candidates who did not know how to apply the restitution equation when the velocities of both particles after collision were the same. Usually, the speed of one of the particles was taken to be zero or some other inappropriate value. Candidates also seemed unfazed by a variety of values for the coefficient of restitution which were not between zero and one. Other parts of the question were all well done with the usual sign errors seen in part (b)(ii).

Q3. Candidates usually took upwards as the positive direction in the suvat equations but failed to use the correct -1.2 in the equations. I was shocked to see how many candidates were not able to solve the quadratic equation using the formula method and many quoted the formula incorrectly. A great many inappropriate methods were seen. Contrary to expectations, candidates who avoided the use of quadratic equations by splitting up the path actually seeded to be more successful.

Q4. This type of question has been set many times before and the solutions are usually marred by candidates' inability to cope with simple linear quadratic equations where the coefficients are not integers. These equations were simpler than most as candidates could have equated $P\sin45^\circ$ and $P\cos45^\circ$ to give an equation in Q. However, not many candidates spotted the short cut.

Q5. Most candidates were well able to find the frictional force but they were not always able to correctly determine which direction the frictional force should be acting. Candidates who thought friction assisted motion were heavily penalised.

Q6. Part (a) was another well done question with some sign errors seen, but these were few and far between. Part (b) was also relatively well done for those candidates who managed to correctly isolate the forces acting on the parcel on the floor of the lift.

Q7. Many candidates were not able to locate the weight of the rod correctly. Some placed it at the end B while others placed it in the middle of the pivots instead of in the middle of the whole rod between A and B. There were the usual sign errors and errors in distances in the moment equations. In part (a), many candidates did not realise that the reaction at the pivot C must be zero. Others obtained the correct equation but only found the mass of the rod rather than its weight required in the question. Still others found the mass correctly but thought that it was the weight.

Q8. This was another well done question though the weight 5g of the particle on the table which acts in a perpendicular direction to the direction of motion were sometimes erroneously included in the equation of motion.

Q9. Questions on the centre of mass of a lamina were usually well done and this was no exception. The most common errors were the location of the centre of mass of the removed triangle XYZ as referred to the origin A.

MATHEMATICS

General Certificate of Education

January 2013

Advanced Subsidiary/Advanced

Principal Examiner: Dr. J. Reynolds

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
S1	912	75	50.0

Grade Ranges

A	61
B	53
C	45
D	37
E	30

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

S1

General Comments

The standard of the candidature was generally good with many candidates submitting excellent scripts. The question on continuous probability distributions, involving calculus, continues to cause problems for many candidates.

Q.1 It was disappointing to note that some candidates interpreted 'independent' as 'mutually exclusive'. It is clearly important, at this level, to appreciate the difference between these two concepts.

Q.2 In (a), some candidates, having shown that $E(X) = 3.2$, then assumed that the variance of X was also 3.2, possibly confusing the binomial distribution with the Poisson distribution. Solutions to (b) were often disappointing with some candidates evaluating $P(X = 11)$ and some others showing that $Y = 11 \Rightarrow X = 3$ but going no further.

Q.3 This question was well answered in general, although some candidates took longer than necessary to solve the problem. For example, in (a), some candidates considered 2 red sweets and 1 green sweet or 2 red sweets and 1 blue sweet separately, apparently not realising that these two possibilities could be combined. Nevertheless, this was the best answered question on the paper.

Q.4 Part (a) was well answered in general, although in (ii) some candidates evaluated the probability by calculating the seven probabilities included in the interval. Although this is a valid method, it is not recommended and the tables should be used. In (b), a common error was to assume that $E(X^2) = \left(E(X)\right)^2 = 144$.

Q.5 In (a)(ii), most candidates realised that because $p > 0.5$, they would have to consider the number of plants, Y, not producing red flowers which had the distribution B(20,0.3). However, some candidates were unable to go from $X > 12$ to $Y < 8$. The simplest way to make this change is to note that since $X + Y = 20$, $X > 12$ implies that $20 - Y > 12$ so that $Y < 8$.

Q.6 Parts (a) and (b) were well answered in general. In (c), however, some candidates doubled the correct answer in the mistaken belief that each possible pair of values could occur in either order.

Q.7 Parts (a) and (b)(i) were well answered by most candidates. However, most candidates were unable to solve (b)(ii). It would seem that few candidates understand that the main purpose of Bayes' Theorem is to update probabilities in terms of observed events. In this problem, the initial assumption in (a) is that the probability of a selected person having the disease is 0.02. Having obtained a positive result, Bayes' Theorem is used in (b)(i) to show that the probability of this person having the disease is now increased to 96/145. Part (b)(ii) can therefore be solved using the method in (a) with the probabilities changed from (0.02,0.98) to (96/145,49/145).

Q.8 As in previous examinations, some candidates fail to understand the difference between probability density functions and cumulative distribution functions and this question was the worst answered question on the paper. In (a)(i), for example, some candidates evaluated $\int_{0.25}^{0.75} F(x)\,\mathrm{d}x$ instead of $F(0.75) - F(0.25)$. In (a)(ii), most candidates correctly derived the equation satisfied by m but many were unable to solve it. Some candidates solved the equation as a quadratic equation in m^2, correctly obtaining $m^2 = 0.293$, but then gave this value as the median, failing to take the square root. In (b), attempts at finding $E(\sqrt{X})$ were often poor with the square root being put in the wrong place. Candidates who wrote down the correct integral often made errors in the integration with the non integral powers causing problems.

MATHEMATICS

General Certificate of Education

January 2013

Advanced Subsidiary/Advanced

Principal Examiner: Dr. J. Reynolds

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
FP1	356	75	57.9

Grade Ranges

A	63
B	55
C	47
D	39
E	32

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

FP1

General Comments

The candidates were well prepared in general with some excellent scripts submitted. As in previous years, the question on induction was poorly answered in general.

Comments on Individual Questions

Q.1 This question was well answered in general with algebraic errors seen only occasionally.

Q.2 This question was well answered by the majority of candidates with the row reduction being carried out correctly.

Q.3 Most candidates knew what had to be done but algebraic errors were sometimes seen.

Q.4 This was the best answered question on the paper. It is pleasing to note that the arithmetic operations are now carried out more accurately than was the case some years ago.

Q.5 It was curious to note that, in (a), many candidates wrote

$$\frac{1}{\beta\gamma}+\frac{1}{\gamma\alpha}+\frac{1}{\alpha\beta}=\frac{\alpha^2\beta\gamma+\alpha\beta^2\gamma+\alpha\beta\gamma^2}{\alpha^2\beta^2\gamma^2} \text{ instead of } \frac{\alpha+\beta+\gamma}{\alpha\beta\gamma}$$

While this is correct, the extra algebra involved sometimes led to errors.

Q.6 The presentation of proof by induction continues to be generally poor. As reported in previous years, 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 the proposition is true for $n = 1$ and true for $n = k$ implies true for $n = k + 1$.

Q.7 Part (a) was well answered by many candidates with logarithmic differentiation understood by the majority. Most candidates were able to show that the stationary point is a minimum by evaluating either $f(x)$ or $f'(x)$ on both sides of the point. Some candidates attempted to evaluate $f''(x)$ at the point although this was not always successful because of the awkward differentiation required. Although more satisfying mathematically, this method should not perhaps be used unless the question requires it.

Q.8 Most questions on this topic in the past have involved 3×3 matrices but most candidates were comfortable with 2×2 matrices on this occasion so that (a) was well answered in general. Part (b), however, was not well answered by many candidates and this question overall was the worst answered question on the paper. Many candidates appeared not to have a strategy for answering (b)(i). The best approach is to define the given parametrically, here $(\lambda, m\lambda)$, then find the image of this general point and finally eliminate λ to give the equation of the image line.

Q.9 This question was well answered in general and it was pleasing to note that many candidates successfully carried out the substitution and elimination required in (b).

WJEC
245 Western Avenue
Cardiff CF5 2YX
Tel No 029 2026 5000
Fax 029 2057 5994
E-mail: exams@wjec.co.uk
website: www.wjec.co.uk