GENERAL CERTIFICATE OF EDUCATION
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EXAMINERS' REPORTS

MATHEMATICS
AS/Advanced

JANUARY 2009

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 2009

Advanced Subsidiary/Advanced

Principal Examiner: 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	2566	75	47.1

Grade Ranges

A	60
B	52
C	44
D	36
E	29

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

General Comments

In general, performance was good on this paper and the majority of candidates found all questions accessible. It was only the last two marks in question 10 which caused general problems and the explanations given here by candidates to justify their answers were many and varied.

Individual questions

Q.1 A well answered question, including part (*d*) which called for a slightly different approach to that which is usually required when dealing with the mid-point of a line.

Q.2 Both parts were, in general, well answered.

Q.3 Part (*a*) caused very few problems but not all candidates realised that the starting point to part (*b*) had to involve finding the gradient of the tangent at Q.

Q.4 Many candidates made errors of computation when trying to find the values of a, b and c. Only a minority knew how to apply their answers to the first part of the question to drawing the graph.

Q.5 The majority of candidates were able to derive the given inequality. Candidates, in general, however, seem far happier to find the range for k in questions where the quadratic inequality is less than zero rather than greater than zero, as was the case here.

Q.6 Most candidates made correct use of Pascal's triangle to answer part (*a*). Very few candidates, however, were able to find the coefficient of x^3 in part (*b*), the most common error being to interpret $(2x)^3$ as $2x^3$.

Q.7 As is usually the case, the question involving the Remainder and Factor theorems was well answered. In part (*b*), however, some candidates left their answer as a product of linear factors and thus lost the final mark.

Q.8 In part (*a*), there was more evidence of improved use of correct notation, although this is far from being universal. Reducing a power of $\frac{2}{3}$ by 1 caused some problems in part (*b*).

Q.9 Part (*a*) was very well answered but there were far fewer correct solutions to part (*b*).

Q.10 Part (*a*) caused few problems but some candidates drew incomplete graphs in part (*b*), which led to incorrect interpretations in part (*c*). Many candidates, however, had little idea of how to use their graph to find the number of real roots of the equation.

MATHEMATICS

General Certificate of Education

January 2009

Advanced Subsidiary/Advanced

Principal Examiner: E Read

Unit Statistics

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Unit	**Entry**	**Max Mark**	**Mean Mark**
C2	954	75	42.8

Grade Ranges

A	54
B	47
C	40
D	33
E	26

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

General Comments

Overall, performance on this year's paper was not as good as has been the case on C2 papers in recent years. Although candidates found most of the questions accessible, solutions to questions 3 and 7 were generally very disappointing.

Individual questions

Q.1 Only a minority of candidates were unable to get full marks for this question.

Q.2 Both parts were generally well answered.

Q.3 A very disappointing question. Many candidates still do not know the correct form of the cosine rule while others thought they had to find $\cos {}^2/_7$ rather than use the fact that $\cos B\hat{A}C = {}^2/_7$. In part (*b*), only a handful of candidates realised they had to first of all use $\sin^2 B\hat{A}C = 1 - \cos^2 B\hat{A}C$ and then use the sine rule to arrive at the final answer.

Q.4 Very few problems arose in this question. In part (*b*), however, hardly anybody used the formula

$$S_n = \frac{n}{2}(a + l)$$

to find the required sum.

Q.5 All parts of this question were generally well answered. Only a minority of candidates, however, were able to earn the final two marks. Many chose $r = {}^4/_3$, thinking that the required condition was $r > 0$ rather than $|r| < 1$.

Q.6 In part (*a*), most, but not all candidates remembered to include the constant of integration. In part (*b*), most were able to find the area under the curve above the x-axis, but relatively few got the final answer completely correct.

Q.7 Another disappointing question. Many candidates got lost in trying to prove the standard result in part (*a*) while only a minority were able to solve the equation in part (*b*) by first of all rewriting it as a power equation. The manipulation of logarithms in part (*c*) was poor.

Q.8 Part (*a*) was, as always, well answered. In part (*b*), most of the candidates who tried to solve the equations of the line and circle simultaneously were able to derive a correct quadratic in *x* and then solve it to find the points of intersection. The majority of candidates knew the required condition for two circles to touch externally and were able to earn full marks in part (*c*).

Q.9 Whereas part (*a*) was relatively straightforward, not all candidates were able to set up the correct equations in part (*b*) and then carry out the required algebraic manipulation to find k.

MATHEMATICS

General Certificate of Education

January 2009

Advanced Subsidiary/Advanced

Principal Examiner: R H Thomas

Unit Statistics

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Unit	Entry	Max Mark	Mean Mark
C3	1769	75	46.3

Grade Ranges

A	55
B	46
C	38
D	30
E	22

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

General comments

The overall performance of candidates was similar to those of previous years. The algebraic skills displayed were sometimes inadequate, particularly in questions 3(*a*) and 10. In general, the sketching of graphs in questions 4 and 8 was unsatisfactory.

Candidates showed good knowledge of Calculus in questions 3, 5 and 7.

Individual questions

Q.1 Most candidates were able to make good use of Simpson's Rule. However, the question caused more difficulty than in previous years mainly because of the negative y values arising in the calculations.

Few candidates were aware that the value of the second integral is equal to twice the value of the first integral.

Q.2 (*a*) Unfortunately, there was a common failure to find two correct values of the expression after choosing a value of θ, e.g. θ = 0° or 90° are particularly helpful.

(*b*) This was well answered except by the weakest candidates.

Q.3 (*a*) Well answered, most candidates gaining high marks.

(*b*) There were relatively few completely correct answers. The following points were noted:-

(i) the rule $\frac{dy}{dx} = \frac{dy}{dt} \Big/ \frac{dx}{dt}$ was well known;

(ii) the differentiation of $4e^{2t}$ proved a stumbling block, $4e^{2t}$ being a popular suggested answer; and

(iii) the simplification of $\frac{8e^{2t} + 3e^{t}}{2e^{t}} = 6$ to $8e^{t} = 9$ was beyond most candidates.

Q.4 (*a*) The attempts at sketching $y = x^3$ and $y = 4 - x$ were very unsatisfactory. Many candidates sketched $y = x^3$ as a parabola and a substantial minority appeared unaware that the equation $y = 4 - x$ represents a straight line. Candidates are advised that they should demonstrate the location of a graph by highlighting appropriate points, e.g. the points (0,4) or (4,0) in the graph of $y = 4 - x$.

Q.5 (*a*) Well answered, although many candidates appeared unaware that $\frac{\cos x}{\sin x} = \cot x$, and also failed to provide a correct simplification in (iii).

(*b*) Well answered by the majority of candidates.

Q.6 (*a*) Surprisingly, many candidates were unable to gain full marks: either there was a failure to isolate $|x|$ or that the equation $|x| = \frac{4}{3}$ results in two possible values of x.

Some candidates were aware that $|x| = x$ for $x \geq o$

$= -x$ for $x < o$

and attempted to use these forms. Whilst this approach is correct (but lengthy), candidates using it failed to arrive at a correct solution.

(*b*) Generally well attempted. Candidates are advised that, to gain full marks, their answers should state clearly that x satisfies both conditions, $x \leq -\frac{3}{5}$ and $x \geq -\frac{11}{5}$ simultaneously.

Q.7 (*a*), (*b*) Well answered, a high scoring question.

Q.8 Whilst the graph of $y = ln\ x$ was often well sketched, there were few satisfactory sketches of $y = -ln\ (x+1)$. Candidates recognised the translation in the negative x-direction but were unable to cope with the minus sign in $-ln\ (x+1)$.

Q.9 (*a*) As in previous years, candidates failed to refer to the domain of f and conclude that the negative root $-\sqrt{\frac{x-4}{5}}$ was appropriate.

(*b*) Reasonably well answered.

Q.10 (*a*) Few candidates were able to give the correct range.

(*b*) There appears to be a continuing lack of understanding that the condition for the formation of gf is that the range of f must be contained in the domain of g.

(*c*) There were a number of good attempts at this question. However, the failure to give the maximum value if k in (b) resulted in candidates being unable to eliminate one of the derived values of k.

MATHEMATICS

General Certificate of Education

January 2009

Advanced Subsidiary/Advanced

Principal Examiner: S Barham

Unit Statistics

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Unit	**Entry**	**Max Mark**	**Mean Mark**
M1	615	75	47.7

Grade Ranges

A	58
B	50
C	42
D	34
E	26

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

General Comments

This proved to be a paper well received by the candidates. The standard and length were comparable to recent papers on this syllabus and did not give rise to any problems generally. There were many candidates who had high marks including many who obtained full marks and pleasingly, very few candidates were down in single figures.

Individual questions

Q1. Apart from candidates who did not know the equations of motion for particles moving under constant acceleration, this question was well done by almost everyone and provided a good start to the paper. However, many errors were seen in part (a), including candidates who found the average speed for the first stage of the journey. Follow through marks were awarded for the correct use of equations in parts (b) and (c).

Q2. Parts (a) and (b) were generally well done apart from the candidates who insisted on starting the graph at the origin rather than (0, 2). Some candidates took the total time of the journey to be 22.5 rather than the correct 24 s. In part (c) many candidates used equations for uniform acceleration by assuming the acceleration was 9.8 ms^{-2} throughout the journey, which was obviously incorrect.

Q3. In part (a), the Newton's second law equation was often correct. The common error is one of sign when a value was substituted for the acceleration and the majority of candidates lost the final accuracy mark. The response to part (b) was disappointing. Many candidates substituted the value 3, which is a velocity, rather than 0 for the acceleration.

Q4. Most candidates were able to find the limiting friction opposing motion for the object on the table and N2L applied to object *B* usually gave a correct equation. However there were many candidates who were not able to apply N2L correctly to the object on the table. The common error is the inclusion of the weight 4g or the omission of the friction. Candidates who tried to use Newton's Method (which we do not recommend) commonly make the mistake of using the wrong mass, usually 6 or 4 rather than 10.

Q5. This question was generally well done though many candidates failed to realise that 5, 12, 13 formed a Pythagorean triple. These candidates found the relevant angle instead which is fine unless the resulting angle is truncated so as to give rise to premature approximation errors. The most common error, which I saw far more often than I could wish, is the omission of the component of weight down the slope in the equation of motion.

Q6. Part (a) was well done generally though many candidates were quite happy to submit a negative answer for the coefficient of restitution. In part (b), a common mistake was an incorrect sign in one of the velocities. Part (c) was a standard collision question and as such was generally well done. A sign error in the restitution equation was common and I could wish for more accurate algebraic manipulation in the solution of the resulting simultaneous equations.

Q7. The only common error in part (a) is the omission of the weight of the rod. A few candidates left out the acceleration due to gravity but still gave their answer in Newtons. Part (b) was not well done. Candidates seemed unable to calculate accurately the required distances when there is a variable involved. Some candidates equated moments which were not about the same point while others omitted g on one side of the equation only coming up with a dimensionally incorrect equation. A few candidates thought that the weight of the rod acted at the point where the string was attached rather than at the centre of the rod.

Q8. Some candidates did not realise that the correct approach was to resolve in two perpendicular direction but most candidates did. However, their skill in solving the resulting equations, though improved from previous years, still leaves a great deal to be desired, and completely correct solutions were rare. Some candidates simply resolved in the directions of each of the strings without including the contribution from the tension in the other string.

Q9. Part (a) was well done generally with the common errors being made in finding the centre of mass of the triangle with respect to the point *A*. Some candidates added the triangle instead of removing it, and others made sign errors in the moment equation though these seem to be rather less common than in previous years. The common error in part (b) is using the wrong right-angled triangle thus finding the wrong angle altogether. Perhaps a diagram would be useful in eliminating these errors. It was disappointing to see so many errors in part (c); 2.5 was a very common answer.

MATHEMATICS

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January 2009

Advanced Subsidiary/Advanced

Principal Examiner: J Reynolds

Unit Statistics

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Unit	Entry	Max Mark	Mean Mark
S1	796	75	43.4

Grade Ranges

A	52
B	45
C	38
D	31
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.

Comments on Individual Questions

Q.1 This question was well answered by most candidates.

Q.2 Solutions to this question were generally disappointing. Many candidates failed to realise that the best approach was to draw a Venn diagram. Candidates who tried to solve the question algebraically were often unsuccessful.

Q.3 This was well answered in general although in (*a*), some candidates misinterpreted the term 'more than' and in (*b*) others misinterpreted the term 'less than' and in calculating the probability of exactly 3, incorrect probabilities were obtained from tables by some candidates.

Q.4 Part (*a*) was well done in general with most candidates familiar with the expectation operator. Part (b), however, caused problems for many candidates with few realising that $Y > 0 \Rightarrow X \geq 3$.

Q.5 This question was well done by many candidates with solutions using combinatorics and solutions multiplying probabilities seen in roughly equal numbers.

Q.6 Most candidates are aware that in problems involving the use of tables with the binomial distribution, the number of failures has to be considered instead of the number of successes when $p > 0.5$. Many, however, are unable to convert $X \geq x$ to $Y = n - x$ in order to find the correct probability.

Q.7 This was reasonably well done with those candidates who drew a tree diagram generally more successful than those who did not.

Q.8 This question was well answered in general. Some candidates, however, seem to think that $\mathrm{Var}(X) = \mathrm{E}(X^2)$. Also in (*b*), some candidates failed to realise that 2 and 6 could occur in two ways and others thought, incorrectly, that 4 and 4 could occur in two ways.

Q.9 Solutions to the question on continuous distributions continue to be disappointing in general. In (*a*), attempts to show that $k = 1/8$ were often unconvincing. In (*b*) and (*c*), many candidates integrated *F*(*x*) in their attempts to find the solutions. In (*d*), many candidates failed to realise that the first step required them to find the probability density function $f(x)$ and then find $\mathrm{E}(X)$ by evaluating $\int_0^2 xf(x)\,\mathrm{d}x$.

<u>Note</u>: It is, in fact, possible to find $\mathrm{E}(X)$ without first finding $f(x)$ by using the result (which can be proved using integration by parts) that if X is a continuous random variable taking values on the interval [0,*a*] and having cumulative distribution function F, then

$$\mathrm{E}(X) = a - \int_o^a F(x)\,\mathrm{d}x$$

However, due to the possibilities of mis-use, it might not be appropriate to mention this result to your candidates.

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Unit	Entry	Max Mark	Mean Mark
FP1	259	75	47.8

Grade Ranges

A	58
B	50
C	42
D	35
E	28

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

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 Q1(*a*) can only be described as extremely poor in general.

Comments on Individual Questions

Q.1 The majority of candidates were unable to solve (*a*) correctly. Some candidates gave the expected incorrect answer

$$\frac{d}{dx}(2^x) = x \times 2^{x-1}$$

Many candidates gave the following solution

$$\ln y = x \ln 2$$

$$\frac{1}{y}\frac{dy}{dx} = \ln 2 + \frac{x}{2}$$

treating the right hand side as a product and thinking that the derivative of $ln2$ is ½. This is disappointing in a paper in Further Pure Mathematics. Solutions to (*b*) were generally satisfactory.

Q.2 This was well done in general with the most common errors being to state that $\sum_{1}^{n} 1 = 1$ and to fail to factorise the final answer.

Q.3 Most candidates knew what had to be done but the algebra defeated some.

Q.4 In (a), some candidates appeared to be unfamiliar with the notation $\bar{z}$ for the complex conjugate. In (*b*), most candidates simplified the complex number to $(-1 + 7\text{i})/5$ but many then gave the argument as $\tan^{-1}(7/-1)$ which their calculator placed in the wrong quadrant. Candidates should be aware that $\arg(x + \text{i}y)$ is not simply $\tan^{-1}(y/x)$ – the correct quadrant has to be found.

Q.5 Most candidates located the fixed point correctly although two common errors were seen in (*b*). Firstly, many candidates gave the centre of rotation as (2,3) instead of the fixed point found in (*a*). Secondly, many candidates gave the angle of the rotation as 53.1° anti-clockwise instead of 53.1° clockwise.

Q.6 Solutions to the induction question were slightly better in general this time although many candidates remain unable to set the proof out correctly.

Q.7 Solutions to this slightly unusual question turned out to be either perfect or non-existent. Candidates who defined $\mathbf{A}$ as

$$\mathbf{A} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

or some other special case were given no credit.

Q.8 Questions on this topic are generally well answered and this was no exception although some candidates were unable to carry out the necessary elimination in (*b*).

Q.9 Most candidates obtained a correct expression for the determinant in (*a*) but attempts at showing that there was only one real root were sometimes unconvincing. Some candidates failed to spot that the equations were consistent when $\lambda = 1$ because the first and third equations are then identical. It was disappointing to see so many arithmetic errors in finding the inverse of $\mathbf{A}$.

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