RECOGNISING ACHIEVEMENT

Mathematics for Engineering

OCR Level 3 Certificate Mathematics for Engineering **H860**

OCR Report to Centres

June 2012

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This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

OCR will not enter into any discussion or correspondence in connection with this report.

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OCR Level 3 Certificate

Mathematics for Engineering (H860)

OCR REPORT TO CENTRES

01 Component 1

General Comments

In order to obtain high marks candidates should be familiar with the whole range of topics listed in the specification. Candidates are advised to look at papers from previous series as part of their preparation.

Answers received were clearly written with correct labelling which facilitated the marking process.

Comments on Individual Questions

1 Good answers included those that used formulae associated with arithmetic and geometric series.

It appeared that some candidates did not recognise this as a standard series question and did not use the appropriate formulae from the List of Formulae (MF1).

(a) (i) The mark for this question was available to those who recognised the situation as a geometric series and used the correct formula given in MF1.

Some responses quoted the correct formula (ar^{i-1}) but did not give values for a and/or r.

(a) (ii) Good answers included those that used the correct summation formula given in MF1. Other answers, which included the manual summation of ten decreasing values, were given some credit.

(a) (iii) Full marks were given to those who derived the result from the summation formula and understood that $(1/2)^n$ tends to zero as n tends to infinity.

(b) (i) Several correct responses identified that 4 triangles should be added at each stage. Full marks were only available to those who quoted the correct arithmetic series formula.

(b) (ii) Several correct answers were seen.

Some candidates did not use the formula, but preferred to manually count the number of triangles often leading to an incorrect solution.

(b) (iii) Full marks were available to those candidates who identified the correct summation formula given in MF1.

2 This question required the identification of eight mutually exclusive categories involving faults (or no faults) of types A, B and C. This would have been clear if candidates had constructed a table or a Venn diagram. Several candidates misunderstood the question. Provided that candidates could identify the number of cars in each category the question was answered well.

(a) (i) Some correct answers were seen. Some incorrect responses gave 'only B' + 'only C' ie 20 + 40 = 60.

(a) (ii) Some correct answers were seen. Some incorrect answers gave 'only A' + 'only B' ie 15 + 20 = 30.

(b) (i) Some candidates understood how to calculate probabilities based upon the number of items in the category required (numerator) and the total number of items (denominator ie 200). Often the numerator was not correct.

(b) (ii) Although the basic principle was understood, the values used were often incorrect.

(c) Good answers should have demonstrated an understanding of conditional probability and used the correct values to arrive at an answer. Candidates should be encouraged to practice questions in this area.

3 In order to obtain good marks in this question candidates should have demonstrated a knowledge of matrices and the solution of simultaneous equations using matrix algebra.

(a) Good responses included those where correct values were inserted into the formulae given and algebraic manipulation was used to arrive at two linear simultaneous equations in two unknowns.

(b) A good response should have used correct matrix notation in the form $Ax = c$ where A is a 2 by 2 matrix and both x and c are column vectors.

(c) This part required the understanding of matrix inversion. Possibly more practice in this area is required.

4 This question required a good understanding of geometry and the necessary tools to analyse geometric shapes. Several candidates did not attempt this question.

(a) Good answers would have started with $(r - SQ)^2 + SR^2 = r^2$.

Some attempts were seen where incorrect assumptions about the geometry were made.

(b) (i) Some candidates correctly recognised that the Pythagorean formula could be used knowing the coordinates of P and R.

(b) (ii) Good solutions would have involved calculating the coordinates of S and then using the Pythagorean formula with the right angle triangle QSR to calculate QP. Other correct solutions involved calculating QR from which SQ could be derived.

(b) (iii) Several candidates managed to use the formula for r given in part (a) with the correct values from parts (b)(i) and (b)(ii).

(b) (iv)& (v) Although a diagram was not required as part of the answer, a diagram showing distances and angles would have facilitated the calculations here.

5 This question required a good understanding of trigonometry and how to manipulate trigonometric formulae.

(a) Several candidates were able to substitute the given expressions into the trigonometric identity given and arrive at the correct answers for p and q.

Candidates should have seen that $\cos(-A) = -\cos(A)$.

Parts (i) and (ii) required evaluating $\cos(\pi/3) = 1/2$ and $\cos(\pi) = 0$ which lead to the required simplified solutions.

(b) Several correct answers were seen from those who attempted this question.

(c) Correct answers related the equation given to the identity at the start of the question. Although full marks were given for correct values (45 and 55) candidates should have quoted Hz in the answer.

6 This question required a basic understanding of periodic functions and knowledge of how to integrate of a product of two functions.

(a) Some candidates managed to give both period and frequency correctly.

(b) This question was not generally well understood.

(c) Some reasonable attempts at this were seen.

Many answers did not, however, attract full marks.

(d) (i) Those candidates who managed to state the correct value for part (a) and the correct formula for (b) were able to obtain the correct result here.

(d) (ii) This question had to use information from parts (a), (b) and (c).

This was not attempted by many candidates.

02 Component 2

General Comments

Many candidates had obviously studied the pre-release document thoroughly and had prepared themselves well for the examination. Some very good responses were seen especially for questions 1 and 2. Candidates should be encouraged to discuss the pre-release document with their tutors and work through the examples given.

It would appear that questions 3 and 4 involving calculus were not fully understood and candidates should possibly give more attention to this area.

In general the answers were well presented with correct question number labels.
This facilitates the marking process and candidates should be encouraged to lay out their work clearly with each question part labelled appropriately.

Comments on Individual Questions

1 (a) (i) Most of the candidates produced a correct answer by relating the lift force to the weight (mg) of the aircraft.

Some candidates attempted to use the formula for L given on page 3 of the pre-release document. Since the lift coefficient was not given this approach did not result in correct answers.

(a) (ii) Nearly all candidates used the correct formula to arrive at a correct result though some used incorrect units.

(b) (i) Correct answers used the drag force equation to obtain an expression for v in terms of the other known values. Correct substitution of the values produced the required results although some answers gave the value for v^2 rather than v.

(b) (ii) This required the understanding that the lift force and the aircraft's weight should be equal for level flight. Several candidates substituted W for L in the lift force equation, rearranged the equation and arrived at the correct answer.

(b) (iii) Most of the candidates stated that the speed of the aircraft would increase. Several candidates, however, did not state that there would also be an increase in altitude.

2 (a) (i) Many correct answers were seen. In some cases only one of the two values required were given resulting in a mark of 1/2.

(a) (ii) Most of the candidates identified the correct formula for the drag force and substituted the correct values arriving at the required answer.

(a) (iii) Many of the candidates obtained correct values for β and f. In addition to the expected formula, $\beta = D/L$, several candidates used C_D/C_L to arrive at the correct result.

(a) (iv) Many of the correct answers used $\gamma = \sin^{-1}(f - \beta)$ with appropriate substitution of values for f and β.

Some correct alternative solutions were seen derived from $F = D + W\sin(\gamma)$.

Solutions that used $\cos(\gamma) = L/D$ were awarded only one mark since it was emphasised at the start of the question that γ was small and therefore $\cos(\gamma) \approx 1$ should have been assumed.

(b) (i) Many candidates understood that the formula for lift force could be used with W substituted for L. Correct rearrangement and substitution of values lead to a correct answer.

(b) (ii) It was expected that candidates performed a linear interpolation between the two appropriate adjacent rows in the table as shown in the published mark scheme.

Many answers were seen without working or explanation and did not qualify for a mark.

(b) (iii) Any values calculated in (b)(i) and (b)(ii) were allowed to be carried forward here.

Provided that the remaining answer used the correct formulae with correct substitution and calculations, full marks were awarded.

3 A few correct answers were given although many candidates did not attempt this question.

In order to answer this question candidates first had to derive an expression for β as either a product ($C_D C_L^{-1}$) or a quotient (C_D/C_L). Many candidates did not do this and attempted to differentiate C_D and C_L separately.

After a correct differentiation candidates were able to solve the resulting quadratic equation to arrive at the required answer.

4 (a) (i) In order to answer this question correctly candidates should have realised that stall speed is reached when the lift force is equal to the weight of the aircraft. Substitution of W for L in the lift force equation and rearranging to make v the subject would have lead to the correct answer.

Only a few candidates attempted this question.

(a) (ii) Correct answers to this involved substituting $F = 150000$ and $M = 45000$ to calculate the constant acceleration $a = F/M$.

Having obtained the acceleration and the stall speed from part (a)(i) the time was obtained from v/a.

(b) (i) This required a direct substitution of formulae and an appropriate rearrangement.

Not too many correct answers were seen.

(b) (ii) Some candidates correctly substituted values for the constants to produce a less cumbersome integration as shown in the guidance column of the published mark scheme. Few complete correct answers were seen.

(b) (iii) This required the integration and rearrangement of $F = ma$ to arrive at $t = mv/F$.

Very few answers were seen.

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