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Mark Scheme (Results)

June 2012

Principal Learning

Engineering
EG308 Paper 01

Mathematical Techniques and Applications for Engineers

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June 2012
Publications Code DP032085

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Mark	
1 (a)	$10^{(2-(-3))}$ $= 10^{5}$ If step 1(using the laws of indices) not shown – 1 mark only	**(2)**	**1** **1**

Question Number	Answer	Mark	
1 (b)	$2gdH = 4flv^2$ $\frac{2gdH}{4fl} = v^2$ $v = \sqrt{\frac{2gdH}{4fl}}$	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
1 (c)	Award only 1 mark if solved by calculator with no evidence of the laws of logs $2 \log 3 + \log x = \log 36$ $\log 3^2 + \log x = \log 36$ $\log x = \log 36 - \log 9$ $\log x = \log 36/9$ $x = 4$	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
1 (d)	0.5197 (11.94 - 8) for evaluation of e terms 0.5197 x 3.94 = 2.05 accept rounding errors	**(2)**	**1** **1**

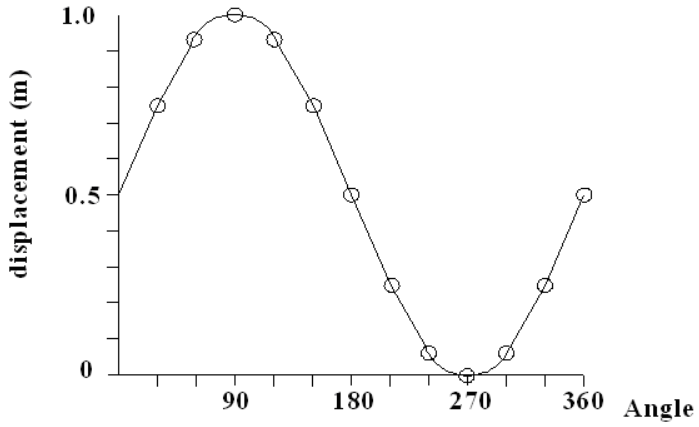
Question Number	Answer	Mark	
2 (a)	Initial volume = 80x40x5 = 16000 Hole volume = π x 8^2 x 5 = 1005.31 Finished plate = 16000 – 1005.31 = 14994.7 mm^3 accept alternative techniques	 **(3)**	**1** **1** **1**

Question Number	Answer	Mark	
2(b)	78.54 = $\frac{\pi d^2}{4}$ or π r^2 $d = \sqrt{\frac{4 \times 78.54}{\pi}}$ d = 10mm accept rounding errors	 **(2)**	 **1** **1**

Question Number	Answer	Mark	
2(c) (i)	Gradient = $\frac{18 - 4}{6}$ = 2.33 or any acceptable gradient intercept = 4, equation: v = 2.33t + 4	 **(3)**	 **1** **1** **1**

Question Number	Answer	Mark	
2 (c) (ii)	v = (2.33 x 2.25) + 4 = 9.24 ms^{-1} or 9.25 ms^{-1} If a reasonable answer is determined by alternative methods but does not relate to the answer in Q2c(i) award 1 mark. Allow follow through up to 2 marks if an incorrect equation is used from Q2c(i).	 **(2)**	 **1** **1**

Question Number	Answer	Mark	
3 (a)	$a^2 = b^2 + c^2 - 2bc \cos A$ = $135^2 + 60^2$ – 2 x135 x 60 x cos 28° = 7521.25 $a = \sqrt{7521.25}$ a = 86.73	 **(4)**	 **1** **1** **1** **1**

Question Number	Answer	Mark	
3(b)	(i)  1 mark for correct shape and angle position 1 mark for amplitude 1 mark for offset (ii) 0 Allow follow through for a correct reading from the graph in Q03b(i)	**(4)**	**1** **1** **1** **1**

Question Number	Answer	Mark	
4(a)	$648 = 6t + ½\ 8t^2$ $4t^2 + 6t - 648 = 0$ $t = \frac{-6 +/- \sqrt{6^2 - (4x4x-648)}}{2x4}$ $t = \frac{-6 +/- 102}{8}$ $t = 12$ or -13.5 (so $t = 12$)	**(4)**	**1** **1** **1** **1**

Question Number	Answer	Mark	
4(b)	1256 x 60 = 75360 rad/min $\frac{75360}{2\pi}$ = 11993.9 rev/min	**(2)**	**1** **1**

Question Number	Answer	Mark	
4(c)	2E + 3T = 107 4E + 2T = 138 4E + 6T = 214 -4T = -76 T = 19 Subs T to get E = 25	**(5)**	**1** **1** **2** **1**

Question Number	Answer	Mark	
5(a)	15 Fifteen	**(1)**	**1**

Question Number	Answer	Mark	
5(b)	15+30+10+15+30+20+15+30+30+15+10+15+20 = 255/13 = 19.62	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
5(c)	Values in order 10, 10, 15, 15, 15, 15, 15, 20, 20, 30, 30, 30, 30 middle value = 15	**(2)**	 **1** **1**

Question Number	Answer	Mark	
5(d)(i)	Any statement that indicates there are two modes e.g. 15 is one of the modes, 30 becomes one of the modes, 15 and 30 are modes, is it bi-modal	**(1)**	

Question Number	Answer	Mark	
5(d)(ii)	Any statement that indicates that the mean has increased e.g. mean increases, new mean is 20.38	**(1)**	

Question Number	Answer	Mark	
5(d)(iii)	No effect on the median, accept 15	**(1)**	

Question Number	Answer	Mark	
6(a) (i)	$\frac{ds}{dt} = 9t^2 - 8t + 5$		**1**
	$= (9 \times 2^2) - (8 \times 2) + 5$		**1**
	$= 36 - 16 + 5$		**1**
	$= 25\ ms^{-1}$	**(4)**	**1**

Question Number	Answer	Mark	
6(a) (ii)	$\frac{dv}{dt} = 18t - 8$		**1**
	$= (18x\ 2) - 8$ $= 36 - 8$		**1**
	$= 28\ ms^{-2}$		**1**
	allow follow through from (a)(i) If acceleration is determined by differentiation of the original relationship, allow follow through of maximum 2 marks Do not accept duplication for 6a(i) and 6a(ii)	**(3)**	

Question Number	Answer	Mark	
6(b)	$v = 5t - 6$		
	$\int_0^5 v = \left[\frac{5t^2}{2} - \frac{6t}{1}\right]_0^5$		**1+1**
	$= (2.5 \times 5^2) - (6 \times 5)$		**1**
	$= 62.5 - 30$		**1**
	distance = 32.5 m	**(5)**	**1**

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Order Code DP032085 June 2012

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