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Mark Scheme (Results)

January 2012

Principal Learning

Engineering
EG308 Paper 01

Mathematical Techniques and Applications for Engineers

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General Marking Guidance

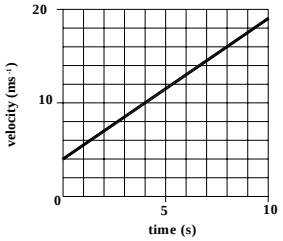
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should 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) (i)	$v^2 - u^2 = 2as$ $\frac{v^2 - u^2}{2s} = a$	**(2)**	**1** **1**

Question Number	Answer	Mark	
1(a) (ii)	$v^2 = u^2 + 2as$ $= 2^2 + 2 \times 4 \times 16$ $v = \sqrt{132}$ $v = 11.49$ allow 1 mark for 132	**(2)**	**1** **1**

Question Number	Answer	Mark	
1(b)	$\log 12 = \log x + 2 \log 2$ $\log 12 - \log 2^2 = \log x$ $\log 12 - \log 4 = \log x$ $\log 12/4 = \log x$ $x = 3$ S.C. If calculated using logs 1 mark only	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
1(c)	$\frac{T_1}{T_2} = e^{u\theta}$ $\frac{400}{175} = e^{u3.22}$ $ln\ 2.286 = 3.22u$ $\frac{0.8268}{3.22} = u$ $u = 0.2567$ allow marks for rounding errors – 2dp	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
2(a)	 (i) Plotting all five points on the graph (with or without line) or accurate line drawn		**1**
	(ii) Gradient = $\frac{16-7}{8-2}$ = 1.5		**1**
	Intercept = 4,		**1**
	so equation : v= 1.5t +4		**1**
	(iii) *v* at 22.5 seconds = (1.5 x 22.5) + 4 *v* at 22.5 seconds = 37.75 ms^{-1}		**1**
	allow follow through	**(5)**	

Question Number	Answer	Mark	
2(b)	$\pi (rh+r^2)$ or $r (\pi h+ \pi r)$		**1**
	$\pi r (h+r)$	**(2)**	**1**

Question Number	Answer	Mark	
2(c)	$x(x+2) = 99$ $x^2 + 2x = 99$ $x^2+2x - 99 = 0$ $(x+11)(x-9)$ $(x+11) = 0$ $(x-9) = 0$ $x = 9$ or $x(x+2) = 99$ $x^2 + 2x = 99$ $x^2+2x - 99 = 0$ $x = \frac{-2 \pm \sqrt{2^2 - (4 \times 1 \times -99)}}{2}$ $x = \frac{-2 \pm \sqrt{4 - (-396)}}{2}$ $x = \frac{-2 \pm \sqrt{400}}{2}$ $x = \frac{-2 \pm 20}{2}$ $x = -11$ $x = 9$	**(4)**	 **1** **1** **1** **1** **or** **1** **1** **1**

Question Number	Answer	Mark	
3(a)	$\tan 16° = \frac{h}{100}$ $h = 100 \times \tan 16°$ $= 100 \times 0.2867$ $h = 28.67$m Sine rule may also be accepted	**(2)**	 **1** **1**

Question Number	Answer	Mark	
3(b)	Horizontal = v x cos 26° = 60 x 0.899 = 53.93 ms^{-1} Vertical = v x sin 26° = 60 x 0.438 = 26.3 ms^{-1}	**(4)**	**1** **1** **1** **1**

Question Number	Answer	Mark	
3(c)	(remaining angle = 110°) $\frac{x}{\sin 28°} = \frac{160}{\sin 110°}$ $x = \frac{160 \times \sin 28°}{\sin 110°}$ $x = \frac{4480}{0.9396}$ x = 79.9mm allow rounding errors	**(4)**	**1** **1** **1** **1**

Question Number	Answer	Mark	
4(a)	Initial plate volume = 70 x 40x 5 = 14000 Volume of 1½ holes = π x 10^2 x 5 x (1.5) = 2356.2 Final volume = 14000 – 2356.2 = 11643.8 mm^3	**(4)**	**1** **1** **1** **1**

Question Number	Answer	Mark	
4(b)	$\frac{2.25 \times 360}{2\pi}$ = 128.9° = 129°	**(2)**	**1** **1**

Question Number	Answer	Mark	
4(c)	$\frac{155 \times 60}{2\pi}$ = 1480 rev/min	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
5(a)	21	**(1)**	**1**

Question Number	Answer	Mark	
5(b)	values in order or statement that identifies how the answer was found 2, 5, 5, 10, 21, 21, 21, 55, 60 middle (median) value = 21	 **(2)**	 **1** **1**

Question Number	Answer	Mark	
5(c)	2+5+5+10+21+21+21+55+60 $\frac{200}{9}$ mean = 22.22	 **(3)**	**1** **1** **1**

Question Number	Answer	Mark	
5 (d)	Explanation with reference to two of the following points: • Refers to a middle or typical value. • Measured using mean, mode or median. • Each calculated differently. • The choice depends on the situation • Affected by the spread/level of standard deviation • Falls between the upper and lower quartiles Any other suitable response 1 mark for each response – maximum 2 marks	 **(2)**	

Question Number	Answer	Mark	
5 (e)	One of the following: • Median would decrease • Not a real value • Value = 15.5 • Between 10 and 21 Any other suitable response	 **(1)**	

Question Number	Answer	Mark	
6(a)	$\frac{dy}{dx} = 3x^2$ $\frac{dy}{dx} = 3 \times 4^2$ $= 3 \times 16$ $= 48$	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
6(b)	$\frac{ds}{dt} = 6 + 4t$ (1 mark for each differentiated term) $= 6 + (4 \times 2)$ $= 6 + 8$ $=14$	**(4)**	**1 + 1** **1** **1**

Question Number	Answer	Mark	
6(c)	$v = 2t + 3$ $\int v = \frac{2t^2}{2} + \frac{3t}{1}$ (1 mark for each integrated term) $\int_0^8 v = (\frac{2 \times 8^2}{2}) + (3 \times 8)$ $s = 64 + 24$ $s = 88m$	**(4)**	**1 + 1** **1** **1**

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