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Mark Scheme (Results)

Summer 2013

Principal Learning

Engineering (EG308/01)

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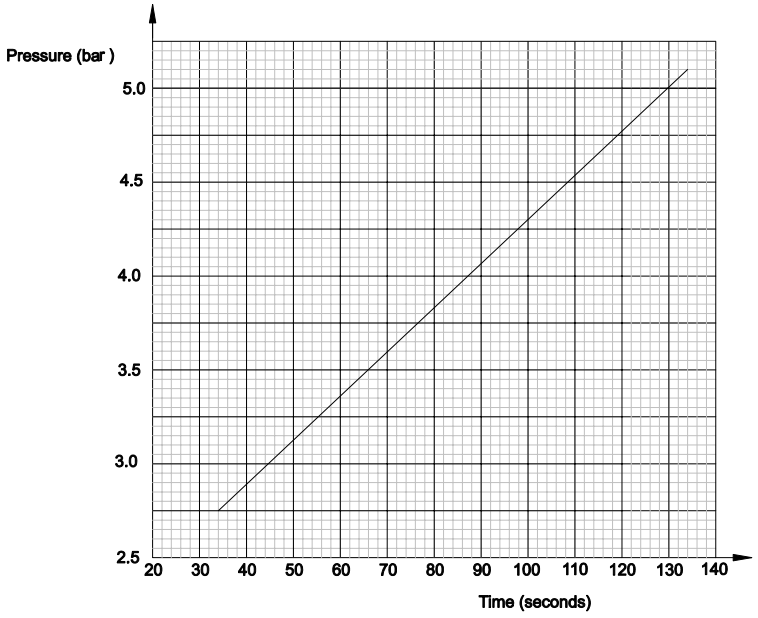
Summer 2013
Publications Code DP035805

Question Number	Answer	Mark	
1 (a) (i)	$\pi r^2\theta = 360A$ $r^2 = \dfrac{360A}{\pi\theta}$ $r = \sqrt{\dfrac{360A}{\pi\theta}}$ In one step = 3 marks	**(3)**	**1** **1** **1**
1(a) (ii)	$r = \sqrt{\dfrac{360\times 588.75}{\pi\times 75}}$ $r = 30$ Allow follow through from (i) Various π values will give 29.9 - 30	**(1)**	**1**

Question Number	Answer	Mark	
1(b)	$\log 4^3 - \log 8 = x\log 2$ $\log\dfrac{64}{8} = x\log 2$ $\log 8 = \log 2^x$ $\sqrt[x]{8} = 2$ or $8 = 2^x$ $x = 3$ S.C. If calculated using logs 1 mark only- expect to see 0.90309 = 0.301 *x*, so *x* = 3 Also $\dfrac{\log 8}{\log 2}$ = x = 3 (2 marks for working to this)	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
1(c)	$\frac{7.25}{10} = e^{\frac{-t}{\tau}}$ $\ln 0.725 = \frac{-t}{15}$ $-t = 15 \times -0.3216$ $t = 4.82$ (allow rounding)	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
2(a)(i)	 Plotted data	**(1)**	**1**

Question Number	Answer	Mark	
2(a)(ii)	$\frac{5.1 - 2.75}{134 - 34} = 0.0235$ Intercept calculated as 1.951 bar – 2.02 bar Allow follow through from gradient $Y = 0.0235t + 1.951$	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
2(b)	$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $t = \frac{-3.5 \pm \sqrt{3.5^2 - 4 \times 3 \times -110}}{2 \times 3}$ $t = \frac{-3.5 \pm \sqrt{12.25 + 1320}}{6}$ $t = \frac{-3.5 \pm 36.5}{6}$ $t = -6.67$ and 5.5 so t must = 5.5	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
2(c) (i)	$(x+1)(x-2)$ $x = -1$ and $x = 2$	**(2)**	**1** **1**
2(c) (ii)	Confirmation x = -1, so (-1)2 – (-1) - 2 = 0, or x = 2, so 22 – 2 – 2 = 0	**(1)**	**1**

Question Number	Answer	Mark	
3(a)	$\sin 12° = h/1200$ $h = 1200 \times \sin 12°$ $h = 249.49$ (sine rule may also be evident) cos function may also be evident	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
3(b)	Interior angle 114° obtained a/sin A = b/sin B 2.3/sin 17° = x/ sin 114° x = 2.3 × sin114°/sin 17° x = 7.19m	**(4)**	**1** **1** **1** **1**

Question Number	Answer	Mark	
3(c) (i)	Value for b obtained directly from graph = 2 **or** from 0° y = 2 = 4 × sin 0 + b So b = 2	**(1)**	**1**

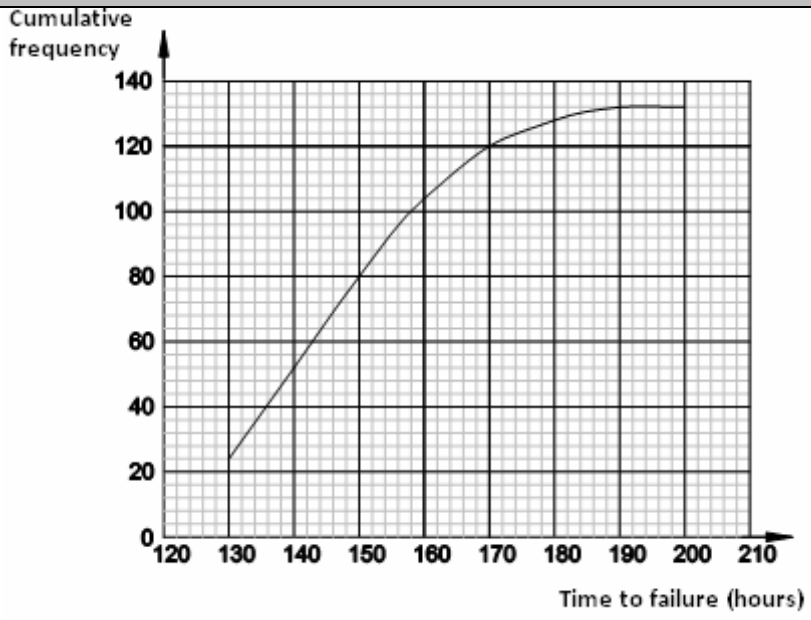
Question Number	Answer	Mark	
3(c) (ii)	y = 4 × sin 120 + 2 = (4 × 0.866) +2 = 5.46 1 mark for value obtained from graph approx 5.5 Allow follow through for use of incorrect value obtained from 3ci	**(2)**	**1** **1**

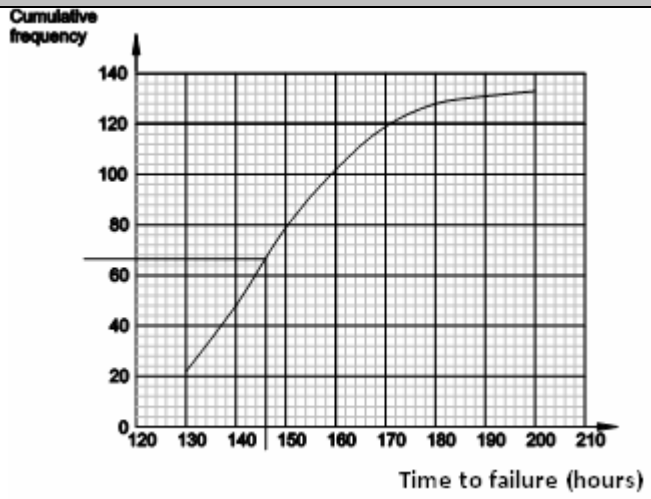
Question Number	Answer	Mark	
4 (a)	Area = π r^2 x2 + πD h = (π x 400 x2) +(π x 40x 130) =2513.27+16336.28 = 18849.56 mm^2 Note: area can also be calculated using $\frac{\pi D^2}{4}$	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
4(b)	3π x 360 4 2π = 1080/8 = 135° Alternative working may be evident to get 135°	**(2)**	**1** **1**

Question Number	Answer	Mark	
4(c)	2600 x 2π = 16336.3 rad/min 16336.3 = 272.27 rad/sec 60 Full marks for solution in one stage, i.e. shown as $2600 \times \frac{2\pi}{60}$	**(2)**	**1** **1**

Question Number	Answer	Mark	
5(a)	Cumulative frequency totals shown as Cumulative Frequency 22 48 79 102 119 128 131 133	**(1)**	**1**

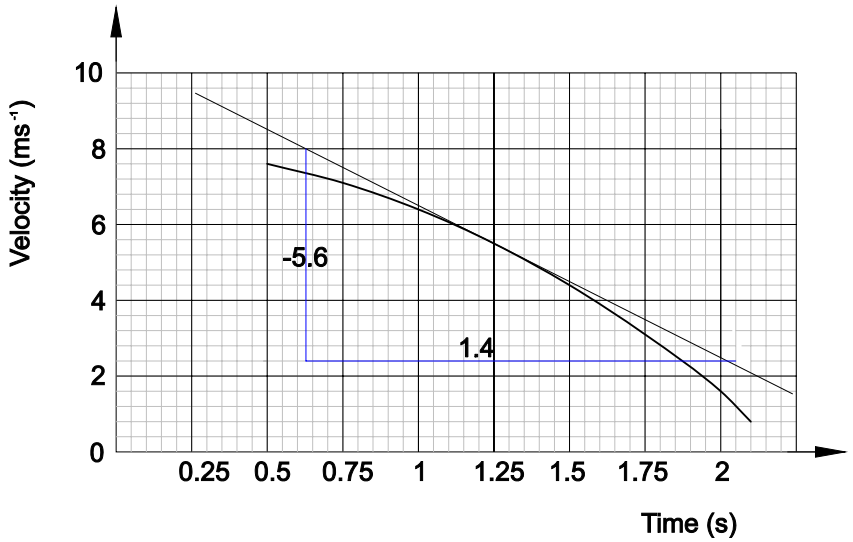
Question Number	Answer	Mark	
5(b)	 Plotted values from CF and line drawn 1 for plot 1 for line Allow F/T from 5(a)	**(2)**	**1** **1**

Question Number	Answer	Mark	
5(c)	 Line drawn at 66.5 or 67 Median = 146 (allowances for plotting and reading graph here)	**(2)**	**1** **1**

Question Number	Answer	Mark	
5 (d)	Working to show mid values x frequency (121+130)/2 ×22 + (131+140)/2 × 26 + (141 + 150)/2 ×31 + (151+160)/2 × 23 + (161+170)/2 ×17 +(171+180)/2 ×9 + (181+190)/2 ×3 + (191+ 200)/2 ×2 =19711.5 Total divided by total frequency so 19711.5/133 to give 148 answer	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
5 (e)	Any two points that indicate prediction and/or prevention • Can identify trends • Early intervention / replace part before failure • Assists planning / Aids planned scheduled maintenance • Reduces likelihood of breakdown • Costs saved/benefit Other suitable responses	**(2)**	**1** **1**

Question Number	Answer	Mark	
6(a)	$\frac{dy}{dx} = 2.4\cos\theta + 3\sin\theta$ 1 mark for each correct differentiation 1 mark for partial knowledge/ attempt such as $2.4\theta\cos\theta - 3\theta\sin\theta$	**(2)**	**1** **1**

Question Number	Answer	Mark	
6(b)	 Tangent at t = 1.25 Gradient values $\frac{-5.6}{1.4}$ Gradient = rate of change = - 4 Allow for graphical reading differences	**(3)**	**1** **1** **1**

Question Number	Answer	Mark	
6(c)	$y = 2t^3 + 4t^2 + 3t - 2$ $\frac{dy}{dx} = 6t^2 + 8t + 3$ $= 6 \times 3^2 + (8 \times 3) + 3$ = 54 + 24 +3 = 81	**(4)**	**1** **1** **1** **1**

Question Number	Answer	Mark	
6(d)	$s = \int_4^6 2t^3 + 4t^2 + 3t - 2 \, dt$ $s = \left[\frac{2t^4}{4} + \frac{4t^3}{3} + \frac{3t^2}{2} - \frac{2t}{1} \right]_4^6$		**1** **1**
	$= \left[\frac{2 \times 6^4}{4} + \frac{4 \times 6^3}{3} + \frac{3 \times 6^2}{2} + 2 \times 6 \right] - \left[\frac{2 \times 4^4}{4} + \frac{4 \times 4^3}{3} + \frac{3 \times 4^2}{2} - 2 \times 4 \right]$		**1**
	= 978 – 229.33 =748.67	**(4)**	**1**

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Order Code DP035805 Summer 2013

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