MEI

Mathematics in Education and Industry

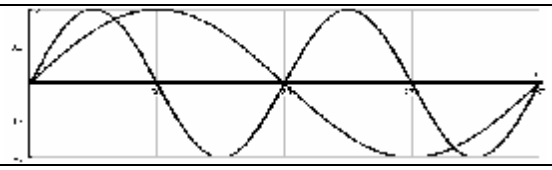
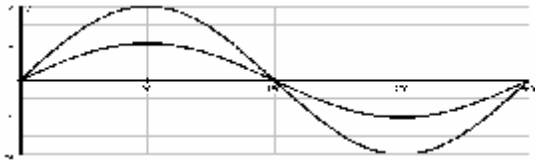
MEI STRUCTURED MATHEMATICS

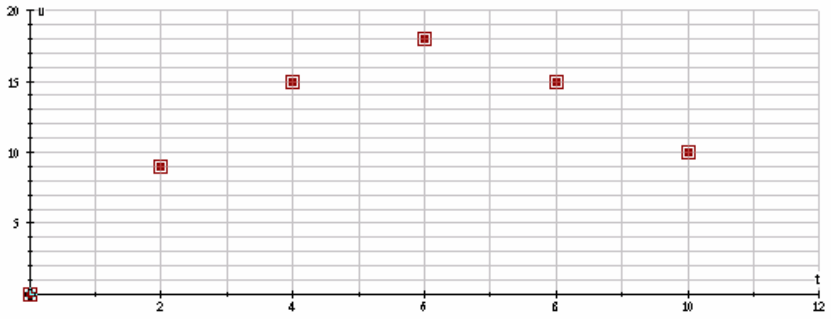
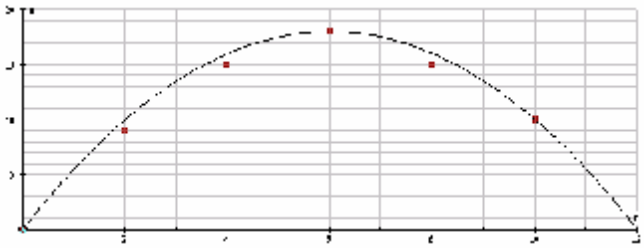
CONCEPTS OF ADVANCED MATHEMATICS, C2

Practice Paper C2-B

MARK SHEME

Qu		Answer	Mark	Comment
Section A				
1		$\sin x + \frac{1}{2}\sqrt{3} = 0 \Rightarrow \sin x = -\frac{1}{2}\sqrt{3}$ $\Rightarrow x = -60^0 \Rightarrow x = 240^0,\ 300^0$	M1 A1 A1 **3**	For 60^0
2		$3^x = 15 \Rightarrow x\log 3 = \log 15$ $\Rightarrow x = \frac{\log 15}{\log 3} = 2.465$	M1 A1 A1 **3**	
3		$5 = \frac{a}{1-r}$ $\Rightarrow 1 - r = \frac{2}{5}$ $\Rightarrow r = \frac{3}{5}$	M1 A1 A1 **3**	
4	**(i)**	$d = 5.9 - 7 = -1.1$	B1 **1**	
	(ii)	For negative sum, $14 - (n-1)1.1 < 0$ $\Rightarrow n - 1 > \frac{1.4}{1.1} \Rightarrow n - 1 > 12.7....$ $\Rightarrow n > 13.7$ i.e. $n \geq 14$ ($S_{13} = 5.2$, $S_{14} = -2.1$)	M1 A1 A1 A1 **4**	
5		$\frac{dy}{dx} = 2 - x \Rightarrow y = 2x - \frac{x^2}{2} + c$. Through (1,2) $\Rightarrow 2 = 2 - \frac{1}{2} + c \Rightarrow c = \frac{1}{2}$ $\Rightarrow y = 2x - \frac{x^2}{2} + \frac{1}{2}$	M1 A1 M1 A1 **4**	
6		$\int_1^2 \left(x^2 + \frac{1}{x^2}\right) dx = \left[\frac{x^3}{3} - \frac{1}{x}\right]_1^2$ $= \left(\frac{8}{3} - \frac{1}{2}\right) - \left(\frac{1}{3} - 1\right)$ $= \frac{13}{6} + \frac{2}{3} = \frac{17}{6}$	M1 A1 A1 M1 A1 **5**	Correct integral of each term Substitute

7	**(i)**	In rt-angled triangle, $a^2 + b^2 = c^2 \Rightarrow \left(\frac{a}{c}\right)^2 + \left(\frac{b}{c}\right)^2 = 1$ $\sin x = \frac{a}{c}$, $\cos x = \frac{b}{c} \Rightarrow \sin^2 x + \cos^2 x = 1$	M1 M1 A1 **3**	
	(ii)	Divide by $\cos^2 x$; $\frac{\sin^2 x}{\cos^2 x} + 1 = \frac{1}{\cos^2 x} \Rightarrow \tan^2 x + 1 = \frac{1}{\cos^2 x}$	M1 A1 **2**	
8	**(i)**		B1 B1 **2**	Shape Intercepts on *x* axis
	(ii)		B1 B1 **2**	Shape Intercepts on *x* axis
9		$s = r\theta \Rightarrow 5 = 0.8r$ $\Rightarrow$ radius = 6.25 cm $A = \frac{1}{2}r^2\theta \Rightarrow A = \frac{1}{2} \times 0.8 \times 6.25^2$ $\Rightarrow$ Area $= 15.625$ cm^2	M1 A1 **2** M1 A1 **2**	
Section B				
10	**(i)**	Angle LAB = 60^0, Angle LBA = 70^0	B1 B1 **2**	
	(ii)	Sin rule : $\frac{LB}{\sin 60} = \frac{5}{\sin 70}$ $\Rightarrow LB = \frac{5 \times \sin 60}{\sin 70} = 4.61$km (2 d.p.) Cosine rule : $= AB^2 = 5^2 + 4.608^2 - 2 \times 5 \times 4.608 \times \cos 50$ $\Rightarrow AB^2 = 16.614 \Rightarrow AB = 4.076$ km $\Rightarrow$ speed = 4.076×2 = 8.15 km per hour	M1 A1 A1 M1 A1 A1 A1 E1 **8**	
	(iii)	AB should be 5 km not 4.08 km. That means it should be a parallel line further out. LA $= \frac{5}{4.08} \times 5 = 6.13$ km	B1 B1 **2**	

11	**(i)**		B1 B1 **2**	Points curve
	(ii)	$A=\frac{h}{2}\left(y_0+2\left(y_2+y_4+y_6+y_8\right)+y_{10}\right)$ $=\frac{2}{2}\left(0+2(9+15+18+15)+10\right)=124$	M1 A1 A1 **3**	Method Substitution C.a.o
	(iii)	$A=\int_0^{10}\left(6t-0.5t^2\right)\mathrm{d}t=\left[3t^2-\frac{0.5t^3}{3}\right]_0^{10}$ $=300-167=133$	M1 A2,1 M1 A1 **5**	Integration Each term Substitute c.a.o.
	(iv)	 John's estimate is under because all the trapezia are under. The area under the curve looks to be over.	B1 B1 **2**	

12	**(i)**	$2x + 2y + \pi x = 10 \Rightarrow y = 5 - x - \frac{1}{2}\pi x$	M1 A1 **2**	
	(ii)	$A = 2xy + \frac{1}{2}\pi x^2$ $= 2x\left(5 - x - \frac{1}{2}\pi x\right) + \frac{1}{2}\pi x^2$ $= 10x - 2x^2 - \frac{1}{2}\pi x^2$	M1 M1 A1 E1 **4**	Attempt at correct elements Substitute for y
	(iii)	$\frac{dA}{dx} = 10 - 4x - \pi x$ $= 0$ when $x = \frac{10}{4+\pi}$ Then $y = 5 - \frac{10}{4+\pi} - \frac{\pi}{2} \times \frac{10}{4+\pi} = 5 - \frac{10+5\pi}{4+\pi}$ $= \frac{5(4+\pi) - 10 - 5\pi}{4+\pi} = \frac{10}{4+\pi}$ Thus $y = x$	M1 A1 M1 A1 M1 E1 **6**	