MEI

Mathematics in Education and Industry

MEI STRUCTURED MATHEMATICS

INTRODUCTION TO ADVANCED MATHEMATICS, C1

Practice Paper C1-C

MARK SHEME

Qu		Answer	Mark	Comment
Section A				
1		$(3x-1)(2x^2-5x+3) = 6x^3-15x^2+9x-2x^2+5x-3$ $= 3x^3-17x^2+14x-3$	M1 A1 **2**	
2		$T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow T^2 = \frac{4\pi^2 l}{g} \Rightarrow l = \frac{T^2 g}{4\pi^2}$	M1 M1 A1 **3**	Square Cross-multiply c.a.o
3		$2x^2-7x \geq 4 \Rightarrow 2x^2-7x-4 \geq 0$ $\Rightarrow (2x+1)(x-4) \geq 0$ $\Rightarrow 2x \geq -1$ and $x \geq 4$ i.e. $x \geq 4$ OR $2x \leq -1$ and $x \leq 4$ i.e. $2x \leq -1$ $\Rightarrow x \geq 4$ or $2x \leq -1$	M1 A1 A1 A1 **4**	both
4	**(i)**	$x^{\frac{5}{2}} \times \sqrt{x} = x^{\frac{5}{2}} \times x^{\frac{1}{2}} = x^3$	B1 B1 **2**	$\sqrt{x} = x^{\frac{1}{2}}$ c.a.o
	(ii)	$12x^{-5} \div 3x^{-2} = 4x^{-5--2} = 4x^{-3}$	B1 B1 **2**	4 x^{-3}
5		EITHER distances^2 = 20, 65, 45 and 20 + 45 = 65 OR 2 gradients are 0.5 and -2 giving m_1m_2 = -1	M1 A1 M1 A1 **4**	Pythagoras All correct Connection
6		$(3-2x)^5 = 3^5 - 5.3^4.2x + 10.3^3.(2x)^2 - .....$ $\Rightarrow$ 3rd term is $10 \times 27 \times 4x^2 = 1080x^2$	M1 A1 A1 A1 **4**	Binomial expansion Coefficient 10 Powers (3^3 and 2^2) c.a.o
7		$3x-2 = x^2+4x-8 \Rightarrow x^2+x-6 = 0$ $\Rightarrow (x+3)(x-2) = 0 \Rightarrow x = 2, \ -3$ $\Rightarrow y = 4, \ -11$ i.e. $(2, 4), \ (-3, -11)$	M1 M1 A1 B1 B1 **5**	
8		$5x-a = 2x+18 \Rightarrow 3x = 18+a$ $\Rightarrow 18+a = 21 \Rightarrow a = 3$ Also $2 \times 7 + 18 = b \Rightarrow b = 32$	M1 M1 A1 M1 A1 **5**	

9	**(i)**	$y = (x+3)^2 - 16$	B1 B1 **2**	
	(ii)	When $y = 0$, $(x+3)^2 = 16 \Rightarrow x+3 = \pm 4 \Rightarrow x = 1, \ -7$ So (1, 0) and (-7, 0). When $x = 0$, $y = 9 - 16 = -7$ So (0, -7).	B1,B1 B1 **3**	
Section B				
10	**(i)**	For A: $(x-1)^2 + (y-4)^2 = 64$ For B: Radius = 4 $\Rightarrow (x-9)^2 + (y-4)^2 = 16$	B1 B1 B1 B1 **4**	LHS, RHS
	(ii)	They meet when $x^2 + y^2 - 2x - 8y - 47 = x^2 + y^2 - 18x - 8y + 81$ $\Rightarrow -2x - 47 = -18x + 81$ $\Rightarrow x = 8$	M1 A1 A1 **3**	
	(iii)	Substitute in either equation: $\Rightarrow 64 + y^2 - 16 - 8y - 47 = 0$ $\Rightarrow y^2 - 8y + 1 = 0$ $\Rightarrow y = \dfrac{8 \pm \sqrt{64-4}}{2} = 4 \pm \sqrt{15}$	M1 A1 A1 M1 A1 **5**	
11	**(i)**			
	(*A*)	$k = 0$	B1 **1**	
	(*B*)	$k = -2$	B1 **1**	
	(*C*)	$f(2) = 8 - 8 - 8 + k = 0 \Rightarrow k = 8$	M1 A1 **2**	
	(*D*)	$f(-1) = -1 - 2 + 4 + k = 5 \Rightarrow k = 4$	M1 A1 **2**	
	(*E*)	$k = 7$	B1 **1**	
	(ii)	$k = 8 \Rightarrow x^3 - 2x^2 + 2x + 8 = 0$ $\Rightarrow (x-2)(x^2-4) = 0$ $\Rightarrow x = 2, \ 2, \ -2$ Cubic graph cutting at (-2, 0) and touching at (2, 0)	M1 A1 A2 B1 **5**	-1 each omission

12	**(i)**	Grad AB $= \frac{4-3}{2--2} = \frac{1}{4}$ Grad BD $= \frac{-4-4}{4-2} = -4$ $\Rightarrow m_1 m_2 = -1 \Rightarrow$ perpendicular	B1 B1 **2**	Both
	(ii)	AB $= \sqrt{(4-3)^2 + (2+2)^2} = \sqrt{17}$ BD $= \sqrt{(-4-4)^2 + (4-2)^2} = \sqrt{68}$ $\Rightarrow$ Area $= \sqrt{17}.\sqrt{68} = \sqrt{17}.2\sqrt{17} = 34$	M1 M1, A1 **3**	c.a.o
	(iii)	CD: $\frac{y+4}{-3+4} = \frac{x-4}{8-4} \Rightarrow 4y+16 = x-4$ $\Rightarrow 4y = x-20$ $\Rightarrow x = 0, \quad y = -5$ i.e. X(0, –5)	M1 E1 **2**	
	(iv)	Midpoint of BX is $\left(\frac{2+0}{2}, \frac{4-5}{2}\right) = \left(1, -\frac{1}{2}\right)$ Midpoint of AD is $\left(\frac{-2+4}{2}, \frac{3-4}{2}\right) = \left(1, -\frac{1}{2}\right)$	M1 E1 **2**	Attempt at any valid method
	(v)	Parallelogram = Trapezium MBCD + Triangle MAB Triangle BXC = Trapezium MBCD + Triangle MXD And triangle MAB is congruent to triangle MXD (SAS) So area of triangle BXC = 34 BX $= \sqrt{(2-0)^2 + (4+5)^2} = \sqrt{85}$ $\Rightarrow$ Area $= \frac{1}{2}$BX $\times$ Perp $= 34 \Rightarrow$ Perp $= \frac{68}{\sqrt{85}} = \frac{4}{5}\sqrt{85}$	B1 M1 A1 **3**	Or equivalent