



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	$(3x-1)(2x^2-5x+3) = 6x^3 - 15x^2 + 9x - 2x^2 + 5x - 3$ $= 6x^3 - 17x^2 + 14x - 3$	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	$2x^2 - 7x \geq 4 \Rightarrow 2x^2 - 7x - 4 \geq 0$ $\Rightarrow (2x+1)(x-4) \geq 0$ $\Rightarrow 2x \geq -1 \text{ and } x \geq 4 \text{ i.e. } x \geq 4$ OR $2x \leq -1 \text{ and } x \leq 4 \text{ i.e. } 2x \leq -1$ $\Rightarrow x \geq 4 \text{ or } 2x \leq -1$	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	$\frac{4}{x^3}$
5	EITHER distances ² = 20, 65, 45 and 20 + 45 = 65 OR 2 gradients are 0.5 and -2 giving $m_1 m_2 = -1$	M1 A1 M1 A1 4	Pythagoras All correct Connection	
6	$(3-2x)^5 = 3^5 - 5 \cdot 3^4 \cdot 2x + 10 \cdot 3^3 \cdot (2x)^2 - \dots$ $\Rightarrow \text{3rd term is } 10 \times 27 \times 4x^2 = 1080x^2$	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: $\Rightarrow 64 + y^2 - 16 - 8y - 47 = 0$ $\Rightarrow y^2 - 8y + 1 = 0$ $\Rightarrow y = \frac{8 \pm \sqrt{64-4}}{2} = 4 \pm \sqrt{15}$	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)	$\text{Grad AB} = \frac{4-3}{2-2} = \frac{1}{4}$ $\text{Grad BD} = \frac{-4-4}{4-2} = -4$ $\Rightarrow m_1 m_2 = -1 \Rightarrow \text{perpendicular}$	B1 B1 2	Both
	(ii)	$\text{AB} = \sqrt{(4-3)^2 + (2+2)^2} = \sqrt{17}$ $\text{BD} = \sqrt{(-4-4)^2 + (4-2)^2} = \sqrt{68}$ $\Rightarrow \text{Area} = \sqrt{17} \cdot \sqrt{68} = \sqrt{17} \cdot 2\sqrt{17} = 34$	M1 M1, A1 3	c.a.o
	(iii)	$\text{CD: } \frac{y+4}{-3+4} = \frac{x-4}{8-4} \Rightarrow 4y+16 = x-4$ $\Rightarrow 4y = x-20$ $\Rightarrow x=0, y=-5$ <p>i.e. X(0,-5)</p>	M1 E1 2	
	(iv)	<p>Midpoint of BX is $\left(\frac{2+0}{2}, \frac{4-5}{2}\right) = \left(1, -\frac{1}{2}\right)$</p> <p>Midpoint of AD is $\left(\frac{-2+4}{2}, \frac{3-4}{2}\right) = \left(1, -\frac{1}{2}\right)$</p>	M1 E1 2	Attempt at any valid method
	(v)	<p>Parallelogram = Trapezium MBCD + Triangle MAB Triangle BXC = Trapezium MBCD + Triangle MXD And triangle MAB is congruent to triangle MXD (SAS)</p> <p>So area of triangle BXC = 34</p> $\text{BX} = \sqrt{(2-0)^2 + (4+5)^2} = \sqrt{85}$ $\Rightarrow \text{Area} = \frac{1}{2} \text{BX} \times \text{Perp} = 34 \Rightarrow \text{Perp} = \frac{68}{\sqrt{85}} = \frac{4}{5} \sqrt{85}$	B1 M1 A1 3	Or equivalent