Mathematics in Education and Industry

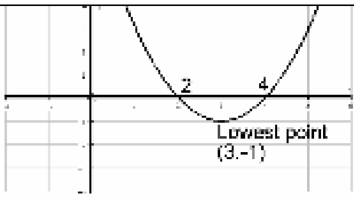
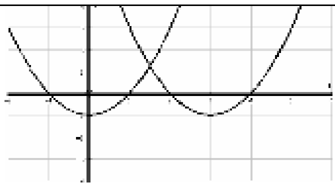
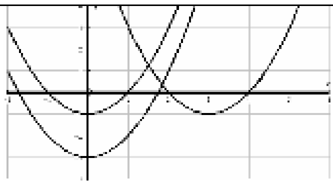
MEI STRUCTURED MATHEMATICS

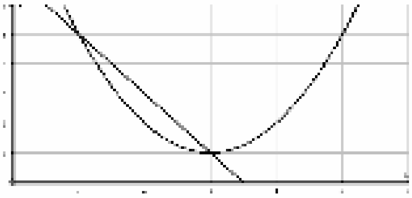
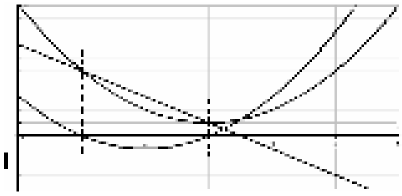
INTRODUCTION TO ADVANCED MATHEMATICS, C1

Practice Paper C1-B

MARK SHEME

Qu		Answer	Mark	Comment
Section A				
1		$s-ut=\frac{1}{2}at^2 \Rightarrow at^2=2(s-ut)$ $\Rightarrow a=\frac{2(s-ut)}{t^2}$	B1 B1 B1 **3**	
2	**(i)**	$x^2+4x+....=(x+2)^2+...$ $\Rightarrow x^2+4x+14=(x+2)^2+14-4=(x+2)^2+10$	M1 A1 A1 **3**	For each value
	(ii)	Greatest value of $\frac{1}{x^2+4x+14}$ = least value of $x^2+4x+14=10$ i.e. Greatest value of $\frac{1}{x^2+4x+14}=\frac{1}{10}$	F1 **1**	
3		Term independent of x is $6x^2.\left(-\frac{2}{x}\right)^2$ (Middle term) Coefficient = 24	M1 A1 A1 **3**	Attempt at correct term Coefficient = 6 cao
4	**(i)**	Grad AB $=\frac{3-2}{1--2}=\frac{1}{3}$; Grad BC $=\frac{-3-3}{3-1}=\frac{-6}{2}=-3$	B1 B1 **2**	
	(ii)	Since $\frac{1}{3}\times(-3)=-1$ the lines are perpendicular So the triangle is right-angled.	B1 **1**	
	(iii)	Distances = $\sqrt{(3-2)^2+(1--2)^2}=\sqrt{1+9}=\sqrt{10}$ and $\sqrt{(3--3)^2+(1-3)^2}=\sqrt{36+4}=\sqrt{40}$ $\Rightarrow$ Area = $\frac{1}{2}\sqrt{10}.\sqrt{40}=10$	M1 A1 **2**	
5	**(i)**	f(2) = 8 – 14 + 6 = 0 so (x – 2) is a factor	B1 **1**	
	(ii)	f(x) = (x – 2)(x^2 +2x – 3) = 0 $\Rightarrow$(x – 2) (x – 1) (x + 3) = 0 $\Rightarrow$ x = 1, 2, -3	M1 A1 A1 B1 **4**	Complete factorisation
6		$2x-9<0 \Rightarrow x<4.5$ $8-x\le 6 \Rightarrow x\ge 2$ $\Rightarrow x=\{2,3,4\}$	M1 A1 A1 **3**	Solving either inequality Each answer Complete set (0 if any extra values)

7	**(a)**	$\left(2+\sqrt{3}\right)^2 = 4+2.2.\sqrt{3}+3 = 7+4\sqrt{3}$	M1 A1 **2**	
	(b)	$\dfrac{1}{x-\sqrt{y}}+\dfrac{1}{x+\sqrt{y}} = \dfrac{x+\sqrt{y}+x-\sqrt{y}}{\left(x-\sqrt{y}\right)\left(x+\sqrt{y}\right)} = \dfrac{2x}{x^2-y}$ If x and y are integers then this is a fraction (not necessarily reduced to lowest terms)	M1 A1 E1 **3**	 Statement
8		Gradient of $3x+2y=5$ is $\dfrac{-3}{2}$ $\Rightarrow$ Gradient of perpendicular line = $\dfrac{2}{3}$ $\Rightarrow y-2=\dfrac{2}{3}(x-1) \Rightarrow 3y-6=2x-2$ $\Rightarrow 3y=2x+4$	B1 M1 A1 **3**	 Accept other forms
9	**(i)**	$(x-1)(x-2)(x-3)-(x^3-x^2+11x-12)$ $=(x^3-6x^2+11x-6)-(x^3-x^2+11x-12)$ $=-5x^2-6+12=6-5x^2$	M1 A1 E1 **3**	
	(ii)	$6-5x^2=0 \Rightarrow x=\pm\sqrt{\dfrac{6}{5}}$	M1 A1 **2**	
Section B				
10	**(i)**	 (2, 0) (4, 0) (0, 6) Lowest point = (3, -1)	B1 B1 B1 B1 B1 **5**	Sketch *x* axis *y* axis *x* coordinate *y* coordinate
	(ii)	$x^2 - 6x + 8 < 0$ for $2 < x < 4$	M1 A1 **2**	
	(iii)		B1 B1 **2**	Same shape Translation by –3
	(iv)	 The transformation is $y = f(x + 3)$ moved down by 2 So from $y = f(x)$ it is "back 3 and down 2" or $\begin{pmatrix}-3\\2\end{pmatrix}$	B1 B1 B1 **3**	 Same shape, moved down 2

11	**(i)**	"$b^2 - 4ac$" = 36 – 40 <0 so no real roots.	M1 E1 **2**	
	(ii)	$x^2 - 6x + 10 = 7 - 2x \Rightarrow x^2 - 4x + 3 = 0$ $\Rightarrow (x-1)(x-3) = 0 \Rightarrow (1,5),\ (3,1)$	M1 A1 A1 A1 **4**	
	(iii)		M1 A1 B1 **3**	Quadratic shape and orientation Fully correct Correct plot for the line
	(iv)	The intersection of this curve with the x axis is the same as the intersection of the line and curve above. 	B1 B1 B1 **3**	 Curve Indication on graph
12	**(i)**	$x^2 + y^2 - 4x - 6y - 12 = 0$ $\Rightarrow (x-2)^2 + (y-3)^2 = 4 + 9 + 12 = 25$ $\Rightarrow$ Centre (2, 3), $r = \sqrt{25} = 5$	M1 A1 A1 A1 **4**	 Centre Radius
	(ii)	Substitute $x = 6$, $y = 0 \Rightarrow 4^2 + 3^2 = 25$ Substitute $y = 0 \Rightarrow (x-2)^2 + 9 = 25$ $\Rightarrow (x-2)^2 = 16$ $\Rightarrow (x-2) = \pm 4 \Rightarrow x = 6$ or -2 $\Rightarrow$B is (-2, 0)	B1 M1 A1 **3**	Alt: solve $x^2 - 4x - 12 = 0$ B1 M1 factorise A1 both answers
	(iii)	Grad QC = $\frac{3-0}{2-6} = -\frac{3}{4} \Rightarrow$ Grad Tangent $= \frac{4}{3}$ $\Rightarrow y - 0 = \frac{4}{3}(x-6) \Rightarrow 3y = 4x - 24$	B1 M1 A1 **3**	
	(iv)	Mid-point of BC is (2, 0). So QM meets the tangent at C when $x = 2$ Then $3y = 8 - 24 = -16$ i.e. $\left(2, -\frac{16}{3}\right)$	M1 A1 **2**	