



**MEI**

Mathematics in Education and Industry

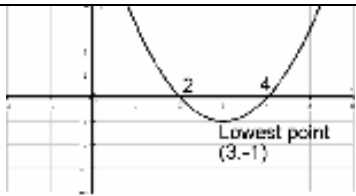
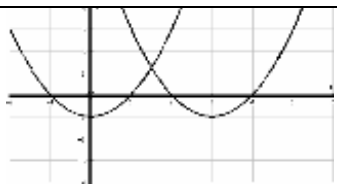
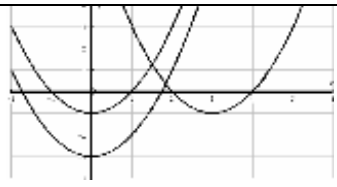
**MEI STRUCTURED MATHEMATICS**

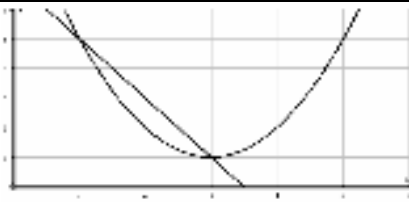
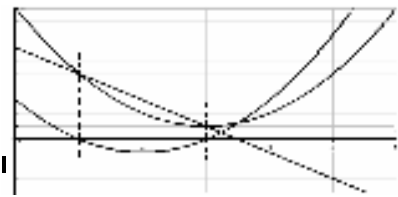
**INTRODUCTION TO ADVANCED MATHEMATICS, C1**

**Practice Paper C1-B**

**MARK SHEME**

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

7	(a)	$(2+\sqrt{3})^2 = 4+2.2.\sqrt{3}+3 = 7+4\sqrt{3}$	M1 A1 2	
	(b)	$\frac{1}{x-\sqrt{y}} + \frac{1}{x+\sqrt{y}} = \frac{x+\sqrt{y}+x-\sqrt{y}}{(x-\sqrt{y})(x+\sqrt{y})} = \frac{2x}{x^2-y}$ 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 $-\frac{3}{2}$ $\Rightarrow$ Gradient of perpendicular line = $\frac{2}{3}$ $\Rightarrow y-2 = \frac{2}{3}(x-1) \Rightarrow 3y-6 = 2x-2$ $\Rightarrow 3y = 2x+4$	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)	$6 - 5x^2 = 0 \Rightarrow x = \pm\sqrt{\frac{6}{5}}$	M1 A1 2	
<b>Section B</b>				
10	(i)	 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

<b>11</b>	<b>(i)</b>	$"b^2 - 4ac" = 36 - 40 < 0$ so no real roots.	M1 E1 <b>2</b>	
	<b>(ii)</b>	$x^2 - 6x + 10 = 7 - 2x \Rightarrow x^2 - 4x + 3 = 0$ $\Rightarrow (x-1)(x-3) = 0 \Rightarrow (1,5), (3,1)$	M1 A1 A1 A1 <b>4</b>	
	<b>(iii)</b>		M1 A1 B1 <b>3</b>	Quadratic shape and orientation Fully correct Correct plot for the line
	<b>(iv)</b>	The intersection of this curve with the $x$ axis is the same as the intersection of the line and curve above. 	B1 B1 B1 <b>3</b>	Curve Indication on graph
<b>12</b>	<b>(i)</b>	$x^2 + y^2 - 4x - 6y - 12 = 0$ $\Rightarrow (x-2)^2 + (y-3)^2 = 4 + 9 + 12 = 25$ $\Rightarrow$ Centre $(2, 3)$ , $r = \sqrt{25} = 5$	M1 A1 A1 A1 <b>4</b>	Centre Radius
	<b>(ii)</b>	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 <b>3</b>	Alt: solve $x^2 - 4x - 12 = 0$ B1 M1 factorise A1 both answers
	<b>(iii)</b>	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 <b>3</b>	
	<b>(iv)</b>	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 <b>2</b>	