Remainder and Factor Theorem, Matrices and Co-ordinate Geometry ANSWERS

1)	(i) (ii)	Matrix multiplication $\mathbf{AB} = \begin{pmatrix} -2 & 2 & 8 \\ 1 & 3 & 20 \end{pmatrix} \text{ or } \mathbf{BC} = \begin{pmatrix} 22 \\ 39 \end{pmatrix}$ Matrix multiplication $\begin{pmatrix} 10 \\ 59 \end{pmatrix}$ $\frac{1}{4} \begin{pmatrix} -3 & 2 \\ -8 & 4 \end{pmatrix} \text{ or } \begin{pmatrix} -0.75 & 0.5 \\ -2 & 1 \end{pmatrix}$ Matrix multiplication $\frac{1}{4} \begin{pmatrix} 4 - 2 & -4 \\ 4 & -4 & -16 \end{pmatrix} \text{ or } \begin{pmatrix} 1 & -0.5 & -1 \\ 1 & -1 & -4 \end{pmatrix}$			M1 A1 M1 A1 [4] B1+B1 M1 A1
2)	(i)	$\sqrt{20}$ or 4.47	B1 [1]		[+]
	(ii)	Grad $AB = \frac{1}{2}$, \perp grad = -2	M1	M1 for attempt at a perp grad	ient
		$\perp \text{ line } y - 4 = -2(x - 1)$	M1, A1	M1 for attempt at straight line must be perpendicular and pa	e equation, ssing through
		(y = -2x + 6)	[3]	A1 allow unsimplified	
	(iii)	Coords of $C(x, y)$ and $BC^2 = 20$ $(x-1)^2 + (y-4)^2 = 20$ or Coords of $C(x, y)$ and $AC^2 = 40$ $(x+3)^2 + (y-2)^2 = 40$	M1 A1	M1 for attempt to obtain relat an appropriate length and the (-3, 2) A1 for a correct equation	tionship using point (1, 4) or
		Need intersection with $y = -2x + 6$, leads to $5x^2 - 10x - 15 = 0$ or	DM1	DM1 for attempt to solve wit and obtain a quadratic equation one variable only	h $y = -2x + 6$ on in terms of
		$5y^2 - 40y - = 0$			
		giving $x = 3, -1$ and $y = 0, 8$	DM1 A1, A1	M1 for attempt to solve quade A1 for each 'pair'	ratic

$f\left(\frac{1}{2}\right) = \frac{a}{8}$	$+1+\frac{b}{2}-2$	M1	M1 for substitution of $x = \frac{1}{2}$ into f (x)	
leading to a	a+4b-8=0	A1	A1 for correct equation in any form	
f(2) = 2f(-2)	x 1)	M1	M1 for attempt to substitute $x = 2$ or $x = -1$ into $f(x)$ and use $f(2) = \pm 2f(-1)$ or $2f(2) = \pm f(-1)$	
$8a \pm 16 \pm 2$	2b = 2(a+4, b, 2)	Δ 1		
8a + 10 + 2	2b - 2 - 2(-a + 4 - b - 2)	AI	AT for a correct equation in any form	
leading to	10a + 4b + 10 = 0 or equivalent			
$\therefore a = -2,$	$b = \frac{5}{2}$	A1 DM1 (on both previous M marks) for A1 attempt to solve simultaneous equations t		
(a) (i)	Equate $f(-3)$ to zero Equate $f(2)$ to 65	M1 ^[6] M1	Al for both correct	
	-54 + 9a - 3b + 21 = 0 (9a - 3b = 33))		
	16 + 4a + 2b + 21 = 65 (4a + 2b = 28)) A1		
	Solve simultaneous equations $a = 5, b = 4$	M1 A1 [5]]	
(ii)	Calculate $f\left(-\frac{1}{2}\right) = -\frac{1}{4} + \frac{a}{4} - \frac{b}{2} + 21$	M1	Or use long division	
	20	A1 [2]		
(a) (i)	<i>X</i> (14, 12)	B1		
	$m_{AX} = \frac{1}{3}$	B1		
	Use $m_1m_2 = -1$ for grad <i>CD</i> from grad <i>AX</i>	M1		
	<i>CD</i> is $y - 4 = -3(x - 10)$			
	y = -3x + 34	A1√	on grad AX	
	AX is $y - 6 = \frac{1}{3}(x + 4)$			
	or 3y - x = 22	B1√	on grad AX	
	Solve eqn for CD with eqn for AX D (8, 10)	M1 A1 [7	[]	
(ii)	Method for area 100	M1 A1 [2	2]	

3)

4)

5)