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

1) 

(i) Matrix multiplication
$\mathbf{A B}=\left(\begin{array}{ccc}-2 & 2 & 8 \\ 1 & 3 & 20\end{array}\right)$ or $\mathbf{B C}=\binom{22}{39}$
Matrix multiplication
$\binom{10}{59}$
(ii) $\frac{1}{4}\left(\begin{array}{ll}-3 & 2 \\ -8 & 4\end{array}\right)$ or $\left(\begin{array}{cc}-0.75 & 0.5 \\ -2 & 1\end{array}\right)$

Matrix multiplication
$\frac{1}{4}\left(\begin{array}{lll}4 & -2 & -4 \\ 4 & -4 & -16\end{array}\right)$ or $\left(\begin{array}{ccc}1 & -0.5 & -1 \\ 1 & -1 & -4\end{array}\right)$

B1+B1

M1
2)

|  | $\sqrt{20} \text { or } 4.47$ | B1 [1] |  |
| :---: | :---: | :---: | :---: |
|  | $\begin{aligned} & \text { Grad } A B=\frac{1}{2}, \perp \operatorname{grad}=-2 \\ & \perp \text { line } y-4=-2(x-1) \\ & (y=-2 x+6) \end{aligned}$ | M1 $\mathrm{M} 1, \mathrm{~A} 1$ | M1 for attempt at a perp gradient <br> M1 for attempt at straight line equation, must be perpendicular and passing through $B$. <br> A1 allow unsimplified |
| (iii) | Coords of $C(x, y)$ and $B C^{2}=20$ $(x-1)^{2}+(y-4)^{2}=20$ or Coords of $C(x, y)$ and $A C^{2}=40$ $(x+3)^{2}+(y-2)^{2}=40$ | M1 $\mathrm{A} 1$ | M1 for attempt to obtain relationship using an appropriate length and the point $(1,4)$ or $(-3,2)$ <br> A1 for a correct equation |
|  | Need intersection with $y=-2 x+6$, leads to $5 x^{2}-10 x-15=0$ or $5 y^{2}-40 y-=0$ | DM1 | DM1 for attempt to solve with $y=-2 x+6$ and obtain a quadratic equation in terms of one variable only |
|  | $\begin{array}{ll} \text { giving } & x=3,-1 \\ \text { and } & y=0,8 \end{array}$ | $\begin{aligned} & \mathrm{DM} 1 \\ & \mathrm{~A} 1, \mathrm{~A} 1 \end{aligned}$ | M1 for attempt to solve quadratic A1 for each 'pair' |

3) 

$\mathrm{f}\left(\frac{1}{2}\right)=\frac{a}{8}+1+\frac{b}{2}-2$
leading to $a+4 b-8=0$
$\mathrm{f}(2)=2 \mathrm{f}(-1)$
$8 a+16+2 b-2=2(-a+4-b-2)$
leading to $10 a+4 b+10=0$ or equivalent
$\therefore a=-2, b=\frac{5}{2}$
4)
(a) (i)
(ii)

Equate $f(-3)$ to zero
Equate $f(2)$ to 65
$-54+9 a-3 b+21=0(9 a-3 b=33)$
or
$16+4 a+2 b+21=65(4 a+2 b=28)$
Solve simultaneous equations
$a=5, b=4$
Calculate $\mathrm{f}\left(-\frac{1}{2}\right)=-\frac{1}{4}+\frac{a}{4}-\frac{b}{2}+21$

20
5)
(a) (i) $\left\lvert\, \begin{aligned} & X(14,12) \\ & m_{A X}=\frac{1}{3}\end{aligned}\right.$

Use $m_{1} m_{2}=-1$ for grad $C D$ from $\operatorname{grad} A X$
$C D$ is $y-4=-3(x-10)$
or
$y=-3 x+34$
$A X$ is $y-6=\frac{1}{3}(x+4)$
or
$3 y-x=22$
Solve eqn for $C D$ with eqn for $A X$ D $(8,10)$
(ii)

Method for area
100

M1

M1 for substitution of $x=\frac{1}{2}$ into $\mathrm{f}(x)$
A1 for correct equation in any form

M1 for attempt to substitute $x=2$ or $x=-1$ into $\mathrm{f}(x)$ and use $\mathrm{f}(2)= \pm 2 \mathrm{f}(-1)$ or $2 \mathrm{f}(2)= \pm \mathrm{f}(-1)$
A1 for a correct equation in any form

DM1 (on both previous M marks) for attempt to solve simultaneous equations to obtain either $a$ or $b$ A1 for both correct

Or use long division

| B1 |  |
| :---: | :---: |
| B1 |  |
| M1 |  |
| A1 $\sqrt{ }$ | $\checkmark$ on $\operatorname{grad} A X$ |
| B1 $\sqrt{ }$ | $\checkmark$ on $\operatorname{grad} A X$ |
| M1 |  |
| A1 [7] |  |
| M1 |  |
| A1 [2] |  |

