No	Answer	Marks
1	$f(x)=1-2x \quad g(x)=3x^2$	
	(a) $(g-f)(x)=g(x)-f(x)$	**M1**
	$=3x^2-1-2x$	**A1**
	(b) $(f\bullet g)(x)=f(x)\bullet g(x)$	**M1**
	$=(1-2x)(3x^2)$	
	$=3x^2-6x^3$	**A1**
	$(f\bullet g)(2)=3(2)^2-6(2)^3$	**M1**
	$=12-48=-36$	**A1**
	(c) $(f\circ g)(x)=f(g(x))$	
	$=f(3x^2)$	**M1**
	$=1-2(3x^2)$	
	$=1-6x^2$	**A1**
	$(f\circ g)(5)=1-6(5)^2$	**M1**
	$=-149$	**A1**
	(d) $(f\circ f)(x)=f(f(x))$	**M1**
	$=f(1-2x)$	
	$=1-2(1-2x)$	
	$=4x-1$	**A1**
	$(f\circ f)\left(\frac{1}{2}\right)=4\left(\frac{1}{2}\right)-1$	**M1**
	$=1$	**A1**
	(e) Domain $g(x)=$ all real numbers	**A1**
	(f) $g(-3)=3(-3)^2$	**M1**
	$=3(9)=27$	**A1**
	(g) $g(x)=3x^2$	**M1**
	$y=3x^2$	
	$x=\sqrt{\frac{y}{3}}$	
	$g^{-1}(x)=\sqrt{\frac{y}{3}}$	**A1**
	$g^{-1}(3)=\sqrt{\frac{3}{3}}$	**M1**
	$=1$	**A1**
		21 Marks

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2	(a) $\begin{bmatrix} -1 & 0 & 1 \\ 1 & 4 & -3 \\ 1 & -2 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ -3 \\ 3 \end{bmatrix}$	**A1**
	(b) $\begin{vmatrix} -1 & 0 & 1 \\ 1 & 4 & -3 \\ 1 & -2 & 1 \end{vmatrix} = -1\begin{vmatrix} 4 & -3 \\ -2 & 1 \end{vmatrix} + \begin{vmatrix} 1 & 4 \\ 1 & -2 \end{vmatrix}$	**M1**
	$= (-1)(4-6) + (-2-4)$ $= 2 + (-6) = -4$	**A1**
	(c) $adj\mathbf{A} = \begin{bmatrix} +\begin{vmatrix} 4 & -3 \\ -2 & 1 \end{vmatrix} & -\begin{vmatrix} 1 & -3 \\ 1 & 1 \end{vmatrix} & +\begin{vmatrix} 1 & 4 \\ 1 & -2 \end{vmatrix} \\ -\begin{vmatrix} 0 & 1 \\ -2 & 1 \end{vmatrix} & +\begin{vmatrix} -1 & 1 \\ 1 & 1 \end{vmatrix} & -\begin{vmatrix} -1 & 0 \\ 1 & -2 \end{vmatrix} \\ +\begin{vmatrix} 0 & 1 \\ 4 & -3 \end{vmatrix} & -\begin{vmatrix} -1 & 1 \\ 1 & -3 \end{vmatrix} & +\begin{vmatrix} -1 & 0 \\ 1 & 4 \end{vmatrix} \end{bmatrix}^T$	**M1**
	$= \begin{bmatrix} -2 & -4 & -6 \\ -2 & -2 & -2 \\ -4 & -2 & -4 \end{bmatrix}^T$	
	$= \begin{bmatrix} -2 & -2 & -4 \\ -4 & -2 & -2 \\ -6 & -2 & -4 \end{bmatrix}$	**A1**
	(d) $\mathbf{A}^{-1} = \dfrac{1}{\lvert\mathbf{A}\rvert}$	
	$= \dfrac{1}{-4}\begin{bmatrix} -2 & -2 & -4 \\ -4 & -2 & -2 \\ -6 & -2 & -4 \end{bmatrix}$	**M1**
	$= \begin{bmatrix} \frac{1}{2} & \frac{1}{2} & 1 \\ 1 & \frac{1}{2} & \frac{1}{2} \\ \frac{3}{2} & \frac{1}{2} & 1 \end{bmatrix}$	**A1**

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	(e) $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} & 1 \\ 1 & \frac{1}{2} & \frac{1}{2} \\ \frac{3}{2} & \frac{1}{2} & 1 \end{bmatrix} \begin{bmatrix} 1 \\ -3 \\ 3 \end{bmatrix}$ $= \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix}$	**M1** **A1** **A1** **A1**
	(f)	**11 Marks**
3	(a) $-2\lvert 2x+3\rvert + 4 \geq -16$ $-2\lvert 2x+3\rvert + 4 - 4 \geq -16 - 4$ $-2\lvert 2x+3\rvert \geq -20$ $\left(-\frac{1}{2}\right)\left(-2\lvert 2x+3\rvert\right) \leq \left(-\frac{1}{2}\right)(-20)$ $\lvert 2x+3\rvert \leq 10$ Case 1: $2x+3 \leq 10$ $2x \leq 7$ $x \leq \frac{7}{2}$ Case 2: $-(2x+3) \leq 10$ $2x+3 \geq -10$ $2x \geq -13$ $x \geq \frac{-13}{2}$	**M1** **A1** **M1M1** **A1A1**
	(b) $\frac{3(x-1)}{2} < x-2$ $3(x-1) < 2x-4$ $3x-3 < 2x-4$ $x < -1$	**M1** **A1**
		8 Marks

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