Question	Answer	Marks	Guidance
6(a)	$f(x)=(x-1)^2+4$	B1	
	$g(x)=(x+2)^2+9$	B1	
	$g(x)=f(x+3)+5$	B1 B1	B1 for each correct element. Accept $p=3, q=5$
		4	

Question	Answer	Marks	Guidance
6(b)	Translation or Shift	B1	
	$\begin{pmatrix}-3\\5\end{pmatrix}$ or acceptable explanation	B1 FT	If given as 2 single translations both must be described correctly e.g. $\begin{pmatrix}-3\\0\end{pmatrix}$ & $\begin{pmatrix}0\\5\end{pmatrix}$ FT from *their* $f(x+p)+q$ *or their* $f(x)\rightarrow g(x)$ Do not accept $\begin{pmatrix}1\\4\end{pmatrix}$ or $\begin{pmatrix}-2\\9\end{pmatrix}$
		2	

Question	Answer	Marks	Guidance
6(a)	Integrate to obtain form $k(5x-3)^{-1}$	*M1	OE
	$4(5x-3)^{-1}$	A1	Or unsimplified equivalent. Condone absence of $\ldots+c$ so far.
	Substitute $x=\frac{4}{5}$ and $y=-3$ to attempt value of c	DM1	DM0 for substituting $\left(-3,\frac{4}{5}\right)$.
	$y=4(5x-3)^{-1}-7$ allow f(x) *or* $f=4(5x-3)^{-1}-7$	A1	OE Condone $c=-7$ as the final answer providing $y=$ or $f(x)=\frac{4}{(5x-3)}+c$ OE is seen earlier. Attempts to write equation in $y=mx+c$ form scores A0. Do not ISW. Gains max 3/4.
		4	
6(b)	Carry out stretch by replacing x by $2x$ in *their* equation	M1	Award if given as the second transformation. Do not ignore sign errors.
	Carry out translation by replacing x by $x-2$ and y by $y-10$	M1	OE Award if given as the first transformation. Do not ignore sign errors.
	$y=\frac{4}{10x-23}+3$	A1	Or similarly simplified equivalent, WWW.
		3	

Question	Answer	Marks
9(a)	$\left[(x-2)^2\right][-1]$	B1 B1
		2
9(b)	Smallest $c=2$ (**FT** on *their* part **(a)**)	B1FT
		1
9(c)	$y=(x-2)^2-1 \rightarrow (x-2)^2=y+1$	*M1
	$x=2(\pm)\sqrt{y+1}$	DM1
	$(f^{-1}(x))=2+\sqrt{x+1}$ for $x>8$	A1
		3

Question	Answer	Marks
9(d)	$\text{gf}(x)=\frac{1}{(x-2)^2-1+1}=\frac{1}{(x-2)^2}$ OE	**B1**
	Range of gf is $0 < \text{gf}(x) < \frac{1}{9}$	**B1 B1**
		3

Question	Answer	Marks	Guidance
1	{Translation} $\begin{pmatrix}\{0\}\\\{-2\}\end{pmatrix}$	**B2, 1, 0**	B2 for fully correct, B1 with two elements correct. {} indicates different elements.
	{Stretch} {[scale] factor 2} {parallel to x-axis}	**B2, 1, 0**	B2 for fully correct, B1 with two elements correct.
		4	Transformations can be in either order.

Question	Answer	Marks	Guidance
2(a)	[p =] 3	**B1**	
		1	
2(b)	[q =] $\frac{1}{2}$	**B1**	
		1	
2(c)	[r =] –2	**B1**	
		1	

Question	Answer	Marks	Guidance
1	$8\left(1-\cos^2\theta\right)+6\cos\theta+1$ $[=0]$	**M1**	Expect $8\cos^2\theta-6\cos\theta-9=0$.
	$(4\cos\theta+3)(2\cos\theta-3)$ $[=0]$	**A1**	Factors or formula or completing square must be shown.
	$[\rightarrow \cos\theta=-0.75\rightarrow\theta=]$ 138.6° only,	**A1**	AWRT, ignore solutions outside the given range, answer in radians A0.
		3	

Question Number	Scheme	Marks
5(a)	$f'(x) = 12x^{-\frac{1}{2}} + \frac{x}{3} - 4$	
	One of $x^{-\frac{1}{2}} \to x^{\frac{1}{2}}$, $-4 \to -4x$, $x \to x^2$	M1
	$f(x) = \int 12x^{-\frac{1}{2}} + \frac{x}{3} - 4\,dx = 24x^{\frac{1}{2}} + \frac{x^2}{6} - 4x + c$	A1A1
	$8 = 24(9)^{\frac{1}{2}} + \frac{(9)^2}{6} - 4(9) + c \Rightarrow c = \ldots$	dM1
	$(f(x) =)\ \ 24x^{\frac{1}{2}} + \frac{x^2}{6} - 4x - \frac{83}{2}$	A1
		(5)
(b)	$f'(9) = \frac{12}{\sqrt{9}} + \frac{9}{3} - 4 \quad (=3)$	M1
	$3 \to -\frac{1}{3}$	dM1
	$y - 8 = "-\frac{1}{3}"(0-9)$	M1
	$(0, 11)$	A1
		(4)
		(9 marks)

Question	Answer	Marks	Guidance
5(d)	(1, 5)	**B1 FT**	FT each coordinate, (*their*8 – 7, *their*2 + 3) Allow vector notation and absence of brackets.
		B1 FT	
		2	

Question	Scheme	Marks
6(a)	E.g. $m=\frac{2-11}{8+4}$ or $m=\frac{11-2}{-4-8}$	M1
	$m=-\frac{3}{4}$	A1
		(2)
(b)	M is $\left(2,\ \frac{13}{2}\right)$	B1
	$m_N=-1\div"-\frac{3}{4}"$	M1
	$y-"\frac{13}{2}"="\frac{4}{3}"(x-"2")$	M1
	$8x-6y+23=0$	A1
		(4)
(c)	$AB=\sqrt{(-4-8)^2+(11-2)^2}\ (=15)$ or $AB^2=(-4-8)^2+(11-2)^2\ (=225)$	M1
	$\frac{1}{2}\times MC\times AB=37.5\Rightarrow MC=\frac{75}{15}\ (=5)$ or $MC^2=25$	M1
	$m_N=\frac{4}{3}, MC=5\Rightarrow C$ is $\left("2"-3,\ "\frac{13}{2}"-4\right)$ or $\left("2"+3,\ "\frac{13}{2}"+4\right)$	dM1
	$(-1,\ 2.5)$ **or** $(5,\ 10.5)$ **or** $x=-1,\ x=5$ **or** $y=2.5,\ y=10.5$	A1
	$(-1,\ 2.5)$ **and** $(5,\ 10.5)$	A1
		(5)
		(11 marks)

Question	Answer	Marks	Guidance
6(c)	$(f(x))>\frac{2}{3}$	**B1**	Allow $(y)>\frac{2}{3}$. Do not allow $x>\frac{2}{3}$
		1	

Question	Answer	Marks	Guidance
2	$x^2-6x+c>2$ leading to $(x-3)^2-9+c>2$	**M1 A1**	M1 for completion of the square with an equation or in equality with the '2'.
	$c>11-(x-3)^2$ and $(x-3)^2\geq 0$	**M1**	SOI
	$c>11$	**A1**	
	Alternative Method 1		
	$\frac{dy}{dx}=2x-6=0$	**M1**	M1 for differentiating and setting $\frac{dy}{dx}=0$.
	$x=3$	**A1**	
	When $x=3$, $y=9-18+c$	**M1**	
	$[-9+c>2]$ $c>11$	**A1**	
	Alternative Method 2		
	$x^2-6x+c>2$ leading to $x^2-6x+c-2[>0]$ then use of 'b^2-4ac'	**M1**	
	$36-4(1)(c-2)<0$	**M1 A1**	OE Must be correct inequality for M1.
	$c>11$	**A1**	
		4	