

1	(a)		Reflection in $y = 0$	1	B1 accept alternative for $y = 0$ e.g. x axis ; if more than one transformation then B0
	(b)		U shaped curve through (2, 6) (3, 0) (5, -6) (7, 0) (8, 6)	2	B2 for a U shaped curve passing through (2, 6) (3, 0) (5, -6) (7, 0) (8, 6) If not B2 then award B1 for either $2f(x - 1)$ passing through at least 3 points from (2, 6) (3, 0) (5, -6) (7, 0) (8, 6) or $2f(x + 1)$ passing through (0, 6) (1, 0) (3, -6) (5, 0) (6, 6) or $2f(x)$ passing through all of (1, 6) (2, 0) (4, -6) (6, 0) (7, 6) or $f(x - 1)$ passing through all of (2, 3) (3, 0) (5, -3) (7, 0) (8, 3) or $2f(x \pm k)$ passing through all of (1 $\pm$ k, 6) (2 $\pm$ k, 0) (4 $\pm$ k, -6) (6 $\pm$ k, 0) (7 $\pm$ k, 6) or A clear translation of the curve using the vector $\begin{pmatrix} 1 \\ k \end{pmatrix}$
Total 3 marks					

2	a		2.5, -60	2	M1 for one correct value
					A1 oe e.g. -2.5 & 120
					SC M1 for drawing cos curve
	bi		(2, 5)	1	B1
	bii		(4, -2)	1	B1
Total 4 marks					

3	(a)(i)		(0, 6)	2	B1
	(iii)		(2, 6)		B1
	(b)	eg $(x - 4)^2 + 3(x - 4) + 4$ oe or eg $(x + \frac{3}{2} - 4)^2 - \frac{9}{4} + 4$ oe or eg $x^2 + 3x + 10$ oe or eg $(x + \frac{3}{2})^2 - \frac{9}{4} + 4 + 6$ oe eg $y - 6 = x^2 + 3x + 4$		2	M1 for applying one of the transformations to the equation
		$y = (x - 4)^2 + 3(x - 4) + 10$ or $y = (x + \frac{3}{2} - 4)^2 - \frac{9}{4} + 4 + 6$			A1 oe eg $y = (x - \frac{5}{2})^2 + \frac{31}{4}$ or $y = x^2 - 5x + 14$ oe
Total 4 marks					

4	$[g(x) =] 2(x-3)^2 - 5$		4	B2	for $a = 2$, $b = 3$ and $c = 5$ correct (stated or shown) (B1 for one of $a = 2$, $b = 3$ and $c = 5$ correct)
	stretch y direction scale factor 2 oe [ft their a] or translation $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$ (ft correct use of their b and c) oe			M1	Stretch and a correct description of the stretch or translation and a correct description of the translation NB: must include the word translation (or translate) and stretch
		Correct transformations in correct order		A1	Stretch y direction scale factor 2 followed by translation $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$ oe eg translation $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$, stretch SF2 in y direction followed by translation $\begin{pmatrix} 0 \\ -5 \end{pmatrix}$
Total 4 marks					
4 Alt	$[g(x) =] 2(x-3)^2 - 5$		4	B2	for $a = 2$, $b = 3$ and $c = 5$ correct (stated or shown) (B1 for one of $a = 2$, $b = 3$ and $c = 5$ correct)
	translation $\begin{pmatrix} 3 \\ -2.5 \end{pmatrix}$ (ft correct use of their b and $0.5c$) oe or stretch y direction scale factor 2 (ft their a)			M1	A correct description of the stretch or the translation
		Correct transformations in correct order		A1	Translation $\begin{pmatrix} 3 \\ -2.5 \end{pmatrix}$ oe followed by stretch y direction scale factor 2
Total 4 marks					

5	(a)(i)	$(-12, 15)$	1	B1
	(ii)	$(-9, 5)$	1	B1
	(b)	$a = 2$ and $b = 90$	2	B2 for both values correct (B1 for $a = 2$ or $b = 90$ or $a = -2$ and $b = -90$)
Total 4 marks				

6	(a)(i)	$(-3, -1)$	1	B1
	(ii)	$(-6, 2)$	1	B1
	(b)	$(p+c, -q)$	2	B2 for $(p+c, -q)$ (B1 for $p+c$ or $-q$ in the correct place)
Total 4 marks				

7	(i)	$(s+2, t)$	1	B1oe accept $(2+s, t)$
	(ii)	$(s, 3t)$	1	B1oe accept $(s, 3 \times t)$ or $(s, t \times 3)$
Total 2 marks				

8	(a)(i)	$(-6, 1)$	2	B1
	(ii)	$(-2, -4)$		B1
	(b)	$(-1, 6), (3, -2), (7, 6)$	2	B2 for a fully correct graph (B1 for a V shape with least value at $(3, -2)$)
	(c)	$-3, 4$	2	B2 for 2 correct values in any order (B1 for 1 correct value)
Total 6 marks				

9	(i)	$(-4, 7)$	1	B1
	(ii)	$(5, 10)$	1	B1
Total 2 marks				

