Multiple Transformations Of Functions Exam Questions (From OCR 4723)

Q1, (Jun 2005, Q9i [Modified])

(i)	Indicate stretch and (at least one) translation	**M1**	[… in general terms]
	State translation by 7 units in negative x direction	**A1**	[or equiv; using correct terminology]
	State stretch in x direction with factor $1/m$	**A1**	[must follow the translation by 7; or equiv; using correct terminology]
	Indicate translation by 4 units in negative y direction	**B1**	**4** [or equiv; at any stage; the two translations may be combined]

Q2, (Jun 2009, Q8i)

(i)	Refer to translation and stretch	M1		in either order; allow here equiv informal terms such as 'move', …
	State translation in x direction by 6	A1		or equiv; now with correct terminology
	State stretch in y direction by 2	A1	3	or equiv; now with correct terminology
	[SC: if M0 but one transformation completely correct, give B1]			

Q3, (Jan 2007, Q7i,ii)

(i)	State a in x-direction	B1		or clear equiv
	State factor 2 in x-direction	B1	**2**	or clear equiv
(ii)	Show (largely) increasing function crossing x-axis	M1		with correct curvature
	Show curve in first and fourth quadrants only	A1	**2**	not touching y-axis and with no maximum point; ignore intercept

Q4, (Jan 2008, Q6i)

(i)	Either:	Refer to translation and reflection	**B1**		in either order; allow clear equivs
		State translation by 1 in negative x-direction	**B1**		or equiv but now using correct terminology
		State reflection in x-axis	**B1**	**3**	using correct terminology
	Or:	Refer to translation and reflection	**B1**		in either order; allow clear equivs
		State reflection in y-axis	**B1**		
		State translation by 1 in positive x-direction	**B1**	**(3)**	with order reflection then translation clearly intended

Q5, (Jan 2010, Q8i)

(i)	State scale factor is $\sqrt{2}$	B1	allow 1.4
	State translation is in negative x-direction …	B1	or clear equiv
	… by $\frac{3}{2}$ units	B1	**3**

Q6, (Jun 2010, Q2)

(i)	Obtain one of $\pm\ln(\pm x \pm 4)$	M1		
	Obtain correct equation $y = -\ln(x-4)$	A1	**2**	or equiv; condone use of modulus signs instead of brackets
(ii)	State, in any order, S, S and T	M1		or equiv such as S^2, T or 2S, T
	State T, then S, then S	A1	**2**	or equiv (note that S, S, T^9 and S, T^3, S are alternative correct answers)
			4	

Q7, (Jun 2011, Q2)

Apply one of the transformations correctly to their equation	B1		
Obtain correct $-3\ln x + \ln 4$	B1		or equiv
Show at least one logarithm property	M1		correctly applied to their equation of resulting curve (even if errors have been made earlier)
Obtain $y = \ln(4x^{-3})$	A1	**4**	or equiv of required form; $\ln 4x^{-3}$ earns A1; correct answer only earns 4/4; condone absence of $y =$
		4	

Q8, (Jan 2012, Q9i)

(i)	Attempt differentiation to find x-coordinate of stationary point or attempt completion of square as far as $(x+...)^2$	M1		or equiv; first two marks of part **(i)** may be earned by work seen in part **(ii)**; $x = -2$ only stated earns M1A1
	Obtain $x = -2$ or $(x+2)^2$	A1		first two marks of part **(i)** are implied by correct answer to translation in x-direction
	State translation by 2 in negative x-direction	A1		or (clear) equiv; allow correct vector
	State translation by 4 in negative y-direction	A1		or (clear) equiv; allow correct vector
	State stretch parallel to y-axis, scale factor k	B1		or equiv at least mentioning y and k
		[5]		

Q9, (Jun 2006, Q8) [Note: Requires knowledge of the form $Rcos(\theta - \alpha)$]

(i)	State $R = 13$	**B1**		or equiv
	State at least one equation of form $R\cos\alpha = k$, $R\sin\alpha = k'$, $\tan\alpha = k''$	**M1**		or equiv; allow sin / cos muddles; implied by correct α
	Obtain 67.4	**A1**	**3**	allow 67 or greater accuracy
(ii)	Refer to translation and stretch	**M1**		in either order; allow here equiv terms such as 'move', 'shift'; with both transformations involving constants
	State translation in positive x direction by 67.4	**A1√**		or equiv; following their α; using correct terminology now
	State stretch in y direction by factor 13	**A1√**	**3**	or equiv; following their R; using correct terminology now

Q10, (Jan 2009, Q7) [Note: Parts i/ii require knowledge of the modulus function]

(i)	Refer to stretch and translation	M1		in either order; allow here informal terms
	State stretch, factor $\frac{1}{k}$, in x direction	A1		or equiv; now with correct terminology
	State translation in negative y direction by a	A1	**3**	or equiv; now with correct terminology
	[SC: If M0 but one transformation completely correct – B1]			
(ii)	Show attempt to reflect negative part in x-axis	M1		ignoring curvature
	Show correct sketch	A1	**2**	with correct curvature, no pronounced 'rounding' at x-axis and no obvious maximum point
(iii)	Attempt method with $x = 0$ to find value of a	M1		... other than (or in addition to) value –12
	Obtain $a = 14$	A1		and nothing else
	Attempt to solve for k	M1		using any numerical a with sound process
	Obtain $k = 3$	A1	**4**	
			9	