

Multiple Transformations Of Functions Exam Questions (From OCR 4723)

Q1, (Jun 2005, Q9i [Modified])

<p>(i) Indicate stretch and (at least one) translation</p> <p>State translation by 7 units in negative x direction</p> <p>State stretch in x direction with factor $1/m$</p> <p>Indicate translation by 4 units in negative y direction</p>	M1	[... in general terms]
	A1	[or equiv; using correct terminology]
	A1	[must follow the translation by 7; or equiv; using correct terminology]
	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) <u>Either</u> : 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
<u>Or</u> : 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 $\pm \ln(\pm x \pm 4)$ Obtain correct equation $y = -\ln(x-4)$	M1 A1 2 or equiv; condone use of modulus signs instead of brackets

(ii) State, in any order, S, S and T State T, then S, then S	M1 or equiv such as S^2 , T or 2S, T 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 $(x + \dots)^2$	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 $R \cos(\theta - \alpha)$]

(i) State $R = 13$ State at least one equation of form $R \cos \alpha = k$, $R \sin \alpha = k'$, $\tan \alpha = k''$	B1	or equiv
Obtain 67.4	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 State stretch, factor $\frac{1}{k}$, in x direction State translation in negative y direction by a [SC: If M0 but one transformation completely correct – B1]	M1 A1 A1	3 3	in either order; allow here informal terms or equiv; now with correct terminology or equiv; now with correct terminology
<hr/>				
(ii)	Show attempt to reflect negative part in x -axis Show correct sketch	M1 A1	2	ignoring curvature with correct curvature, no pronounced 'rounding' at x -axis and no obvious maximum point
<hr/>				
(iii)	Attempt method with $x = 0$ to find value of a Obtain $a = 14$ Attempt to solve for k Obtain $k = 3$	M1 A1 M1 A1	4	... other than (or in addition to) value -12 and nothing else using any numerical a with sound process
			9	