Core 2 Transformations Answers

Q	Solution	Marks	Total	Comments
6(a)(i)	Stretch (I) in y-direction (II) Scale factor 2 (III) 	M1A1	2	>1 transformation is M0. M1 for (I) and either (II) or (III) or (III)
(ii)	Reflection; in x-axis	M1 A1	2	'Reflection'/ 'reflect(ed)' (or in y-axis or $y = 0$ or $x = 0$)
(iii)	Translation; $\begin{bmatrix} 30 \\ 0 \end{bmatrix}$	B1 B1	2	'Translation'/'translate(d)' Accept full equivalent in words provided linked to 'translation/move/shift' and positive x-direction (Note: B0 B1 is possible)
(b)	$\{\theta - 30° =\} \sin^{-1}(0.7) = 44.4...°$ $......... = 180° - 44.4°$ $\theta = 74.4°,\ 165.6°$	M1 m1 A1	3	Inverse sine of 0.7 PI eg by sight of 44, 74 or better Valid method for 2nd angle Condone >1dp accuracy
(c)	$... = \cos^2 x + 2\cos x \sin x + \sin^2 x +$ $\cos^2 x - 2\cos x \sin x + \sin^2 x$ $.... = 2\cos^2 x + 2\sin^2 x$ $= 2(\cos^2 x + \sin^2 x) = 2\,(1)$ $= 2$	M1 A1 M1 A1	4	Award for either bracket expanded correctly OE $\cos^2 x + \sin^2 x = 1$ stated or used. AG (be convinced)
		Total	13	

Question	Solution	Marks	Total	Comments
8(a)	Stretch (I) in x-direction (II) scale factor 2 (III)	M1 A1	2	Need(I) and one of (II),(III) M0 if more than one transformation
(b)	$\tan^{-1}3 = 1.2(49\ldots) \;(=\alpha)$	M1		$\tan^{-1}3$ [PI by 71.(56..)°]
	$\{\frac{1}{2}x=\}\;\; \pi + \alpha$;	m1		Correct quadrant; condone degrees or mix
	$\frac{1}{2}x = 1.249\ldots;\; 4.3906\ldots$			
	$x = 2.498\ldots = 2.50$ to 3 sf	A1		Condone 2.5 otherwise deduct **max** of 1 mark throughout Q8 from A marks if 'correct' rads. but to 2sf or final answers in degrees. (143°, 503°)
	$x = 8.781\ldots = 8.78$ to 3 sf	A1	4	
				As usual, accept greater accuracy answers. Ignore extra values outside the given interval (0 to12.6). If >2 values inside interval lose an A mark for each one.
				NB M1m0A1A0 is possible
	SC after M0 for error $\tan x = 6$; Either $x = 1.40(5),\; 4.54(7),\; 7.68(8),\; 10.8(3)$ or $x = 80.5°,\; 260.5°,\; 440.5°,\; 620.5°$ SC B1 $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ (accept each rounded or truncated to 3 sf)			
(c)	$\cos\theta = 0, \quad \sin\theta - 3\cos\theta = 0$	M1		Need both
	$\tan\theta = \dfrac{\sin\theta}{\cos\theta}$ or $\tan\theta = 3$	M1		$\tan\theta = \dfrac{\sin\theta}{\cos\theta}$ seen/used
	$\cos\theta = 0 \Rightarrow \theta = \dfrac{\pi}{2} = 1.57(07\ldots)$	B1		Accept $\dfrac{\pi}{2}$
	or $\theta = \dfrac{3\pi}{2} = 4.71(23..)$	B1		Accept $\dfrac{3\pi}{2}$
	$\tan\theta = 3 \Rightarrow$ $\theta = 1.249..;\; 4.3906\ldots = 1.25,\; 4.39$ to 3sf	A1✓		If not correct, ft on (b) NB M0M1(B0B0)A1ft is possible
			5	90°; 270°; 71.5(6)°; 251.5(6)°
	Total		11	

Q	Solution	Marks	Total	Comments
7(a)		M1		Correct shape of branch from O {to 90°} or correct shapes of branches from 90°-360°
		A1		Complete graph for $0° \leq x \leq 360°$ (Asymptotes not explicitly required but graphs should show 'tendency')
		A1	3	Correct scaling on x-axis $0° \leq x \leq 360°$
(b)	61° ;	B1		For 61°
	241°	B1	2	For 241° and no 'extras' in the interval $0° \leq x \leq 360°$
(c)(i)	$\sin \theta = -\cos \theta \Rightarrow \dfrac{\sin \theta}{\cos \theta} = -1$ $\Rightarrow \tan \theta = -1.$	B1	1	AG; be convinced that the identity $\dfrac{\sin \theta}{\cos \theta} = \tan \theta$ is known and validly used
(ii)	$\Rightarrow \tan(x - 20°) = -1$	M1		
	$x - 20° = \tan^{-1}(-1)$	m1		
	$x - 20° = 135°, 315° \ldots$			
	$x = 155°$;	A1		
	335°	A1ft	4	Ft on $(180 + $ "155" $)$ and no 'extras' in the given interval.
(d)	Translation	B1		'Translation'/'translate(d)'
	$\begin{bmatrix} 20 \\ 0 \end{bmatrix}$	B1	2	Accept equivalent in words provided linked to 'translation/move/shift' (Note: B0B1 is possible)
(e)	$f(x) = \tan 4x$	B1	1	For $\tan 4x$
	Total		13	

8(a)	$\{x =\}\ \cos^{-1}(0.3) = 1.266....\ \{= \beta\}$	M1		$\cos^{-1}(0.3)$ PI by eg 72° or 73°	
	$\{x =\}\ 2\pi - \beta$	m1		Condone degrees or mix.	
	$x = 1.27,\ 5.02$	A1	3	Accept 1.26 to 1.27 with 5.01 to 5.02 inclusive	
(b)(i)	$M(\pi, -1)$	B1;B1	2	B1 for each coordinate	
(ii)	$\{x_Q =\}\ 2\pi - \alpha$	B1	1	OE (unsimplified)	
(c)	Stretch (I) in x-direction (II) scale factor $\frac{1}{2}$ (III)	M1 A1	2	Need(I) & one of (II),(III)	
(d)	$\cos 2x = \cos\dfrac{4\pi}{5} \Rightarrow 2x = \dfrac{4\pi}{5}$	B1		OE. (From correct work)	
	$\Rightarrow x = \dfrac{2\pi}{5}\ (= \alpha)$			Condone decimals/degrees	
	$x = \pi - \alpha;$ OE	M1		OE eg $2x = 2\pi - \dfrac{4\pi}{5}$ Correct quadrant; condone degrees/decimals/mix	
	$x = \pi + \alpha;\ x = 2\pi - \alpha;$ OE	m1		Need both (OE for $2x=$) with no extras (quadrants) within the given interval. Condone degrees/decimals/mix	
	$x = \dfrac{2\pi}{5},\ \dfrac{3\pi}{5},\ \dfrac{7\pi}{5},\ \dfrac{8\pi}{5}$	A1	4	Need all 4 solutions for x but condone unsimplified provided in terms of π Ignore extra values outside the given interval.	
	Total		12		