Question number	Scheme	Marks
10 (a)	$(x+\frac{\pi}{3})=\frac{\pi}{3}$ or $\frac{2\pi}{3}$ or $\frac{7\pi}{3}$	M1
	$(x+\frac{\pi}{3})=\frac{\pi}{3}$ and $\frac{2\pi}{3}$ and $\frac{7\pi}{3}$	A1
	$x=0,\frac{\pi}{3},2\pi$	A1 (3)
(b)	$\tan\theta=-\frac{5}{3}$	M1
	θ = –59°, –239°, 121°, 301°	M1 A1 (3)
(c)	$1+\sin 2y-2(1-\sin^2 2y)=0$	M1
	$2\sin^2 2y+\sin 2y-1=0$	A1
	$(\sin 2y+1)(2\sin 2y-1)=0$	
	$\sin 2y=-1$ or $\sin 2y=\frac{1}{2}$	dM1
	$2y$ = –90°, (30°), (150°), –330°, –210°	A1
	y = –45°, – 105°, –165°	A1 (5)
		[11]

Part	Mark	Additional Guidance
(a)	M1	Any one of the three indicated angles, radians only, ignore any other angles.
	A1	For all three indicated angles, ignore other angles out of the range $\frac{\pi}{3}\le x+\frac{\pi}{3}\le\frac{7\pi}{3}$
	A1	For all three angles, ignore angles out of range, A0 if additional angles in range.
(b)	M1	For $\tan\theta=k.\ \ k\neq 0,\ k\neq\pm 1$
	M1	Any one correct value, does not need to be to the nearest degree. Allow one correct value to imply the first M1. Ignore any other angles.
	A1	For all four angles, ignore angles out of range, A0 if additional angles in range. All four angles must be given to the nearest degree.
(c)	M1	For the correct use of $1-\sin^2 2y$ in the equation on the left or right side, equation doesn't need to be = 0.
	A1	Correct 3TQ, must be = 0 and a valid attempt to solve leading to sin 2y =
	dM1	$\sin 2y=-1$ or $\sin 2y=\frac{1}{2}$ (allow sin2y = a and b from a valid attempt to solve their 3TQ). Allow sin2y to be x or any other variable.
	A1	For minimum of 3 of the 5 values shown, (including the ones in brackets), ignore other angles outside the range -360° ≤ 2y ≤ 360°. Allow sight of 270 if -90° present.
	A1	For all 3 values shown. Ignore extras out of range. **Rounding answers (where accuracy is specified in the question)** Penalise only once per question for failing to round as instructed - ie giving more digits in the answers.

Question number	Scheme	Marks
11 (a)	$\mathbf{b}-\mathbf{a}$	B1 (1)
(b)	$\overrightarrow{OZ}=\overrightarrow{OB}+\lambda\overrightarrow{BX}\,(=\mathbf{b}+\lambda(-\mathbf{b}+2\mathbf{a}))$	M1
	$=(1-\lambda)\mathbf{b}+2\lambda\mathbf{a}$	A1
	$\overrightarrow{OZ}=\overrightarrow{OA}+\mu\overrightarrow{AY}\,(=\mathbf{a}+\mu(-\mathbf{a}+3\mathbf{b}))$	M1
	$=(1-\mu)\mathbf{a}+3\mu\mathbf{b}$	A1
	$(1-\lambda)\mathbf{b}+2\lambda\mathbf{a}=(1-\mu)\mathbf{a}+3\mu\mathbf{b}$	ddM1
	$2\lambda=1-\mu$ $3\mu=1-\lambda$	A1
	$3(1-2\lambda)=1-\lambda$ or $2(1-3\mu)=1-\mu$	M1
	$\lambda=\frac{2}{5}$ or $\mu=\frac{1}{5}$	A1
	$\overrightarrow{OZ}=\frac{1}{5}(4\mathbf{a}+3\mathbf{b})$ See notes regarding alternatives	A1 (9)
(c)	$\overrightarrow{OM}=p\text{"}\frac{1}{5}(4\mathbf{a}+3\mathbf{b})\text{"}$ and $\overrightarrow{OM}=2\mathbf{a}+q(-2\mathbf{a}+3\mathbf{b})$	M1
	$\frac{4p}{5}=2-2q$ and $\frac{3p}{5}=3q$	M1
	(Solving these equations leads to $p=\frac{5}{3}$)	
	$\overrightarrow{OM}=\frac{1}{3}(4\mathbf{a}+3\mathbf{b})$	A1 (3)
		[13]

Part	Mark	Additional Guidance
(a)	B1	For the indicated vector
(b)	M1	For any correctly written vector path, must include a parameter
	A1	For the vector shown
	M1	For any correctly written vector path, must include a parameter
	A1	For the vector shown
	ddM1	Equates their 2 vectors – this mark may be implicit in the candidate equating the two components of their 2 vectors, **dependent on the first two method marks.**
	A1	Correct equations as shown
	ddM1	Full and correct method to solve their two simultaneous equations, either by substitution as shown or by elimination. There must be no errors in the method to eliminate λ or μ, **dependent on the first two method marks.**
	A1	Correct value for λ or μ
	A1	Correct vector.
	There are a number of alternatives for part b, all marked in the same way. Examples: ALT1 $\mu\,\overrightarrow{XB}$ and $\lambda\,\overrightarrow{AY}$ (must use to get $\overrightarrow{AB}$ for 2nd A1) equate 2 vectors for $\overrightarrow{AB}$ ALT2 $\overrightarrow{AZ} = \overrightarrow{AX} + \mu\,\overrightarrow{XB}$ M1A1 $\overrightarrow{AZ} = \lambda\,\overrightarrow{AY}$ M1A1 equate 2 vectors for $\overrightarrow{AZ}$ ddM1 The A1 ddM1 A1 A1 following these marks should all be marked in the same way as the main mark scheme.	
(c)	M1	For the two correct vectors shown, allow use of their $\overrightarrow{OZ}$
	dM1	Correctly equating the components of their vectors for $\overrightarrow{OZ}$ and arriving at a value for p or q
	A1	For the correct vector, as shown.
	Can also be done using other vectors eg finding two alternatives for $\overrightarrow{OM}$ Mark in the same way as main scheme.	

Question number	Scheme	Marks
12 (a)	$(2\cos x = 0)$ $\quad (x=)\dfrac{\pi}{2}$ or 90 °	B1 (1)
(b)	$(2\cos x = 2\sin x)$ $\quad \tan x = 1$	M1
	$x = \dfrac{\pi}{4}$ or 45°	A1 (2)
(c)	$\int_{(0)}^{(``\frac{\pi}{4}")} (2\sin x)dx + \int_{(``\frac{\pi}{4}")}^{(``\frac{\pi}{2}")} (2\cos x)dx$	M1
	$[-2\cos x]_0^{\frac{\pi}{4}} + [2\sin x]_{\frac{\pi}{4}}^{\frac{\pi}{2}}$	A1
	$\left(-\sqrt{2}+2\right)+\left(2-\sqrt{2}\right) = 4-2\sqrt{2}$	dM1
	$= 4-\sqrt{8}$ cao	A1cao cso (4) **[7]**

Part	Mark	Additional Guidance
(a)	B1	For $\dfrac{\pi}{2}$ or 90 degrees. Can also be shown as a coordinate – ignore any incorrect y coordinate.
(b)	M1	For $\tan x = 1$
	A1	For $\dfrac{\pi}{4}$ or 45 degrees. Can also be shown as a coordinate – ignore any incorrect y coordinate.
(c)	M1	For both integrals correctly shown, with an addition sign between them. Limits need not be shown. Must be 2 integrals shown. Can't be shown as one integral with incorrect limits.
	A1	For both functions correctly integrated. Limits need not be shown.
	dM1	For their limits clearly and correctly substituted in or for the numerical expression(s) shown in the MS. If mark awarded for substitution, both integrated expressions must have both limits correctly substituted. 0 must be the lower limit on the first integral. Allow ft of their $\dfrac{\pi}{4}$ (must be the upper limit on the first integral and the lower limit on the second and can be in degrees) and their $\dfrac{\pi}{2}$ (must be the upper limit on the second integral and can be in degrees).
	A1	cao cso A0 if degrees used in part c
		Note, can also be completed as either integral doubled – symmetry. M1 – correct integral stated with multiply by 2 evident or implicit later. A1 correctly integrated dM1 – as for main scheme, the multiply by 2 must be clearly shown. A1 as main scheme