Question	Scheme	Marks	AOs
14(a)	Attempts to use $\sin(x+30°)=\sin x\cos 30°\pm\cos x\sin 30°$ $\cos(x+30°)=\cos x\cos 30°\mp\sin x\sin 30°$ $\Rightarrow \pm\sin x\cos 30°\pm\cos x\sin 30°\pm\sqrt{3}(\pm\cos x\cos 30°\pm\sin x\sin 30°)$	M1	2.1
	Correct expression $\sin x\cos 30°+\cos x\sin 30°+\sqrt{3}(\cos x\cos 30°-\sin x\sin 30°)$	A1	1.1b
	States or implies that $\sin 30°=\frac{1}{2}$ and $\cos 30°=\frac{\sqrt{3}}{2}$ $=\frac{\sqrt{3}}{2}\sin x+\frac{1}{2}\cos x+\sqrt{3}\left(\frac{\sqrt{3}}{2}\cos x-\frac{1}{2}\sin x\right)=2\cos x$ *	A1*	2.1
		(3)	
(b)	$2\cos\theta=3\sin 2\theta\Rightarrow 2\cos\theta=6\sin\theta\cos\theta$	M1	2.1
	$\sin\theta=\frac{1}{3}$	A1	1.1b
	$\theta=\arcsin\frac{1}{3}\Rightarrow\theta=...$	dM1	1.1b
	$(\theta=)$ awrt 19.5°, awrt 160.5°, 90°	A1	2.2a
		(4)	
			(7 marks)

Notes:

(a) **Condone a complete proof entirely in θ (or another variable) instead of *x*.**
Do not be concerned with the omission of degrees.

M1: Attempts to use both compound angle expansions to set up an expression in sin *x* and cos *x*
i.e. $\pm\sin x\cos 30°\pm\cos x\sin 30°\pm\sqrt{3}(\pm\cos x\cos 30°\pm\sin x\sin 30°)$
The terms must be correct but condone sign errors and a slip on the multiplication of the $\sqrt{3}$ if they attempt to multiply out the brackets. (The $\sqrt{3}$ may be omitted entirely)
This mark may be implied by further work
e.g. $\pm\frac{\sqrt{3}}{2}\sin x\pm\frac{1}{2}\cos x\pm\sqrt{3}\left(\pm\frac{\sqrt{3}}{2}\cos x\pm\frac{1}{2}\sin x\right)$

A1: Correct expression $\sin x\cos 30°+\cos x\sin 30°+\sqrt{3}(\cos x\cos 30°-\sin x\sin 30°)$ o.e.
May be implied by
$\frac{\sqrt{3}}{2}\sin x+\frac{1}{2}\cos x+\sqrt{3}\left(\frac{\sqrt{3}}{2}\cos x-\frac{1}{2}\sin x\right)$ (or implied if multiplied out)

A1*: Proceeds to the given answer with **no errors seen including invisible brackets** (condone a missing trailing bracket). We must see the exact numerical values used for $\sin 30°$ and $\cos 30°$ before proceeding to the given answer.
Minimum required
$\frac{\sqrt{3}}{2}\sin x+\frac{1}{2}\cos x+\sqrt{3}\left(\frac{\sqrt{3}}{2}\cos x-\frac{1}{2}\sin x\right)=2\cos x$ which scores M1A1A1*
$\sin x\cos 30°+\cos x\sin 30°+\sqrt{3}(\cos x\cos 30°-\sin x\sin 30°)=2\cos x$ scores M1A1A0*
There should not be any notational or bracketing errors and no mixed or missing variables.

Alternative for part (a)

M1: Writes the left hand side of the equation as

$$\frac{1}{2}\sin\left(x+30°\right)+\frac{\sqrt{3}}{2}\cos\left(x+30°\right)=\sin 30°\sin\left(x+30°\right)+\cos 30°\cos\left(x+30°\right)$$

A1: Correct expression for $\sin 30°\sin\left(x+30°\right)+\cos 30°\cos\left(x+30°\right)=\cos x$

A1*: Proceeds to the given answer $\sin\left(x+30°\right)+\sqrt{3}\cos\left(x+30°\right)=2\cos\left(x+30°-30°\right)=2\cos x$ with **no errors seen including invisible brackets** (condone a missing trailing bracket). There should not be any notational or bracketing errors and no mixed or missing variables.

Alternative part (a) – using the *R*-alpha method

M1: States e.g. $R\cos(x+30\pm\alpha)=\sqrt{3}\cos(x+30)\mp\sin(x+30)$

and attempts to find either R or α correctly. (may be implied)

A1: Achieves $2\cos(x+30-30)$

A1*: Achieves $2\cos x$ with no errors seen and both stages of working shown e.g.

- States $\left(R\cos(x+30\pm\alpha)=\right)\sqrt{3}\cos(x+30)\cos\alpha\mp\sin(x+30)\sin\alpha$ oe
- Shows $R=\sqrt{1+3}=2$ and $\tan\alpha=\left(\frac{1}{\sqrt{3}}\right)$ o.e. e.g. using cosine or sine

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(b) Condone the use of *x* for θ and mixed variables

M1: Sets $2\cos\theta=3\sin 2\theta$ and proceeds to $A\cos\theta=B\sin\theta\cos\theta$. (allow $A=B$)
May be implied by $\sin\theta=k$ $(k\neq 0,1)$

A1: $\sin\theta=\frac{1}{3}$

dM1: Finds at least one of their values of θ for their $\sin\theta=k$ $(k\neq 0,1)$ It is dependent on the previous method mark. You may need to check their value(s) (in degrees or radians) but may be implied by e.g. awrt $19°$ (or awrt $20°$) or awrt $161°$ (or awrt $160°$)
(awrt 0.34 or awrt 2.8 in radians)

A1: Deduces that $\left(\theta=\right)90°$ as well as giving $\left(\theta=\right)$ awrt $19.5°$, awrt $160.5°$ with no other values in the given range (ignore any found outside of the range)
The degree symbol is not required. (Note the angles are 19.4712206…and 160.528779…)
Answers in radians score A0.