Question	Scheme	Marks
7(i)(a)	Reflection or in the line $y=-x$	M1
	Reflection in the line $y=-x$	A1
		(2)
(b)	$\begin{pmatrix} -\frac{1}{2} & \frac{\sqrt{3}}{2} \\ -\frac{\sqrt{3}}{2} & -\frac{1}{2} \end{pmatrix}$ or $6\times\begin{pmatrix} \pm\cos 240° & \pm\sin 240° \\ \pm\sin 240° & \pm\cos 240° \end{pmatrix}$	M1
	$\begin{pmatrix} -3 & 3\sqrt{3} \\ -3\sqrt{3} & -3 \end{pmatrix}$	A1
		(2)
(c)	$\mathbf{R}=\mathbf{QP}=\begin{pmatrix} -3 & 3\sqrt{3} \\ -3\sqrt{3} & -3 \end{pmatrix}\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}=...$	M1
	$=\begin{pmatrix} -3\sqrt{3} & 3 \\ 3 & 3\sqrt{3} \end{pmatrix}$ **QP** correctly found	A1
		(2)
(ii)	$\begin{pmatrix} -2 & 2\sqrt{3} \\ 2\sqrt{3} & 2 \end{pmatrix}\begin{pmatrix} \lambda \\ 1 \end{pmatrix}=\begin{pmatrix} 4\lambda \\ 4 \end{pmatrix}\Rightarrow\begin{pmatrix} -2\lambda+2\sqrt{3} \\ 2\lambda\sqrt{3}+2 \end{pmatrix}=\begin{pmatrix} 4\lambda \\ 4 \end{pmatrix}$	M1
	$-2\lambda+2\sqrt{3}=4\lambda$ or $2\lambda\sqrt{3}+2=4$	A1
	$\Rightarrow 6\lambda=2\sqrt{3}\Rightarrow\lambda=...$ or $2\sqrt{3}\lambda=2\Rightarrow\lambda=...$	dM1
	$\lambda=\frac{\sqrt{3}}{3}$ or $\frac{1}{\sqrt{3}}$ oe	A1
	Both $-2\lambda+2\sqrt{3}=4\lambda$ and $2\lambda\sqrt{3}+2=4$ solved leading to $\lambda=\frac{\sqrt{3}}{3}$ or $\frac{1}{\sqrt{3}}$	A1
		(5)
		(11 marks)

Notes:

(a)
M1: Identifies the transformation as a reflection or identifies the correct line of reflection.

A1: Fully correct description, with the equation of the line of reflection or suitable description (e.g. in the line through angle 135° with the positive *x*-axis). Ignore any references to a centre of reflection.

(b)

M1: Either the correct matrix for the rotation (with trig ratios evaluated) or an attempt at scaling a matrix of form shown by a factor 6 (need not evaluate ratio) – if no trig ratios seen this may be implied by the exact values in the right places. The correct answer implies the M.

A1: Correct matrix.

(c)

M1: Attempts to multiply **Q** and **P** in the correct order.

A1: QP correct

(ii)

M1: Attempts the product $\begin{pmatrix} -2 & 2\sqrt{3} \\ 2\sqrt{3} & 2 \end{pmatrix}\begin{pmatrix} \lambda \\ 1 \end{pmatrix}$ and sets equal to $\begin{pmatrix} 4\lambda \\ 4 \end{pmatrix}$. Allow for poor notation as long as the intention is clear, and it may be implied by one correct equation or follow through equation.

A1: Extracts at least one correct equation (not part of the matrix equation). May be implied by correct value for λ following correct matrix equation.

dM1: Attempts to solve the equation. May be implied by the correct value following a correct matrix equation with no extraction of separate equations.

A1: Correct value for λ from at least one equation and isw if incorrectly simplified (allow if their second equation does not concur).

A1: Correct value for λ coming from both equations, solved explicitly, or checks the value of λ from the first equation works in the second equation.

Alt (ii)	$\begin{pmatrix} -2 & 2\sqrt{3} \\ 2\sqrt{3} & 2 \end{pmatrix}\begin{pmatrix} \lambda \\ 1 \end{pmatrix}=\begin{pmatrix} 4\lambda \\ 4 \end{pmatrix}\Rightarrow\begin{pmatrix} \lambda \\ 1 \end{pmatrix}=\frac{1}{-4-12}\begin{pmatrix} 2 & -2\sqrt{3} \\ -2\sqrt{3} & -2 \end{pmatrix}\begin{pmatrix} 4\lambda \\ 4 \end{pmatrix}$ $\Rightarrow\begin{pmatrix} \lambda \\ 1 \end{pmatrix}=-\frac{1}{16}\begin{pmatrix} 8\lambda-8\sqrt{3} \\ -8\lambda\sqrt{3}-8 \end{pmatrix}$	**M1**
	$2\lambda=\sqrt{3}-\lambda$ or $2=\lambda\sqrt{3}+1$	**A1**
	$\Rightarrow 3\lambda=\sqrt{3}\Rightarrow\lambda=...$ or $\sqrt{3}\lambda=1\Rightarrow\lambda=...$	**dM1**
	$\lambda=\frac{\sqrt{3}}{3}$ or $\frac{1}{\sqrt{3}}$	**A1**
	Both $2\lambda=\sqrt{3}-\lambda$ and $2=\lambda\sqrt{3}+1$ solved leading to $\lambda=\frac{\sqrt{3}}{3}$ or $\frac{1}{\sqrt{3}}$	**A1**
		(5)

Notes:

M1: Correct attempt at inverse, attempts the product $\begin{pmatrix} -2 & 2\sqrt{3} \\ 2\sqrt{3} & 2 \end{pmatrix}^{-1}\begin{pmatrix} 4\lambda \\ 4 \end{pmatrix}$ and sets equal to $\begin{pmatrix} \lambda \\ 1 \end{pmatrix}$.

Allow for poor notation as long as the intention is clear, and it may be implied by one correct equation or follow through equation.

A1: Extracts at least one correct equation (not part of the matrix equation). May be implied by correct value for λ following correct matrix equation.

dM1: Attempts to solve the equation. May be implied by the correct value following a correct matrix equation with no extraction of separate equations.

A1: Correct value for λ from at least one equation (allow if their second equation does not concur).

A1: Correct value for λ coming from both equations, solved explicitly, or checks the value of λ from the first equation works in the second equation.