Question	Scheme	Marks
5(a)	Two of: Rotation; about O; through 60° $\left(\frac{\pi}{3}\right)$ (anticlockwise)	M1
	All of: Rotation about O through 60° $\left(\frac{\pi}{3}\right)$ (anticlockwise)	A1
		(2)
(b)	$\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$	B1
		(1)
(c)	$\mathbf{R} = \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}\begin{pmatrix} \frac{1}{2} & -\frac{\sqrt{3}}{2} \\ \frac{\sqrt{3}}{2} & \frac{1}{2} \end{pmatrix}$	M1
	$= \begin{pmatrix} -\frac{\sqrt{3}}{2} & -\frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{pmatrix}$ **QP** correctly found	A1
		(2)
(d)	$3\mathbf{R} = \begin{pmatrix} -\frac{3\sqrt{3}}{2} & -\frac{3}{2} \\ -\frac{3}{2} & \frac{3\sqrt{3}}{2} \end{pmatrix}$ or correctly deals with 3 as a multiple.	B1ft
	Required matrix is $(3\mathbf{R})^{-1} = \frac{1}{\left(-\frac{3\sqrt{3}}{2}\right)\left(\frac{3\sqrt{3}}{2}\right)-\left(-\frac{3}{2}\right)\left(-\frac{3}{2}\right)}\begin{pmatrix} \frac{3\sqrt{3}}{2} & \frac{3}{2} \\ \frac{3}{2} & -\frac{3\sqrt{3}}{2} \end{pmatrix} = \ldots$ Or $(\mathbf{R})^{-1} = \frac{1}{\left(-\frac{\sqrt{3}}{2}\right)\left(\frac{\sqrt{3}}{2}\right)-\left(-\frac{1}{2}\right)\left(-\frac{1}{2}\right)}\begin{pmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ \frac{1}{2} & -\frac{1\sqrt{3}}{2} \end{pmatrix} = \ldots$	M1
	$(3\mathbf{R})^{-1} = \frac{1}{-9}\begin{pmatrix} \frac{3\sqrt{3}}{2} & \frac{3}{2} \\ \frac{3}{2} & -\frac{3\sqrt{3}}{2} \end{pmatrix} = \begin{pmatrix} -\frac{\sqrt{3}}{6} & -\frac{1}{6} \\ -\frac{1}{6} & \frac{\sqrt{3}}{6} \end{pmatrix}$	A1
		(3)
		(8 marks)

Notes:

(a)

M1: Two aspects of the type, centre of rotation and angle correct. Accept equivalent angles or angle in radians. (E.g. 300° clockwise is fine). Assume anticlockwise unless otherwise stated.

A1: Fully correct description. Accept just 60° for the angle, but 60° clockwise is incorrect

(b)

B1: Correct matrix.

(c)

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

A1: QP correct

(d)

B1ft: Multiplies all elements of their matrix by 3, or multiplies all elements of their $\mathbf{R}^{-1}$ by $\frac{1}{3}$

M1: Attempts the inverse of their 3**R** or **R**. This must be a complete method – ie must transpose and evaluate the determinant and use it. Alternatively, they may attempt an inverse from first principles. Award this mark if a slip is made in solving their simultaneous equations.

A1: Correct answer. Accept alternative forms