Question	Scheme	Marks	AOs
3 (a)	Rotation	B1	1.1b
	30 degrees or $\frac{\pi}{6}$ about the x – axis Ignore any reference to direction	B1	1.1b
		(2)	
(b)	They have found **AB** when they should find **BA** Multiplication is the wrong way round It should be **BA** Matrix B should be on the left instead of the right Student has done transformation B followed by transformation A It should be $\begin{pmatrix} 1 & 3 & 0 \\ \sqrt{3} & 0 & 5\sqrt{3} \\ 1 & 2 & 0 \end{pmatrix}\begin{pmatrix} 1 & 0 & 0 \\ 0 & \frac{\sqrt{3}}{2} & -\frac{1}{2} \\ 0 & \frac{1}{2} & \frac{\sqrt{3}}{2} \end{pmatrix}$	B1	2.3
		(1)	
(c)	$\left\{\begin{pmatrix} 1 & 3 & 0 \\ \sqrt{3} & 0 & 5\sqrt{3} \\ 1 & 2 & 0 \end{pmatrix}\begin{pmatrix} 1 & 0 & 0 \\ 0 & \frac{\sqrt{3}}{2} & -\frac{1}{2} \\ 0 & \frac{1}{2} & \frac{\sqrt{3}}{2} \end{pmatrix}\right\} = \begin{pmatrix} 1 & \frac{3\sqrt{3}}{2} & -\frac{3}{2} \\ \sqrt{3} & \frac{5\sqrt{3}}{2} & \frac{15}{2} \\ 1 & \sqrt{3} & -1 \end{pmatrix}$ $\left\{\begin{pmatrix} 1 & 3 & 0 \\ \sqrt{3} & 0 & 5\sqrt{3} \\ 1 & 2 & 0 \end{pmatrix}\begin{pmatrix} 1 & 0 & 0 \\ 0 & \frac{\sqrt{3}}{2} & -\frac{1}{2} \\ 0 & \frac{1}{2} & \frac{\sqrt{3}}{2} \end{pmatrix}\right\} = \begin{pmatrix} 1 & \frac{3\sqrt{3}}{2} & -1.5 \\ \sqrt{3} & \frac{5\sqrt{3}}{2} & 7.5 \\ 1 & \sqrt{3} & -1 \end{pmatrix}$	B1	1.1b
		(1)	
			(4 marks)

Notes:

(a)

B1: Identifies the single transformation as a rotation only

B1: Correct angle and axis. Ignore any reference to direction.

Note x-plane, zy-plane and $x = 0$ are 2nd B0

Any additional incorrect statements is 2nd B0

(b)

B1: Explains that they should be multiplied the other way around

(c)

B1: Correct exact matrix

Note: $5\sqrt{3}\times\frac{\sqrt{3}}{2}$ must be simplified to $\frac{15}{2}$

Condone $\frac{2\sqrt{3}}{2}$ not simplified