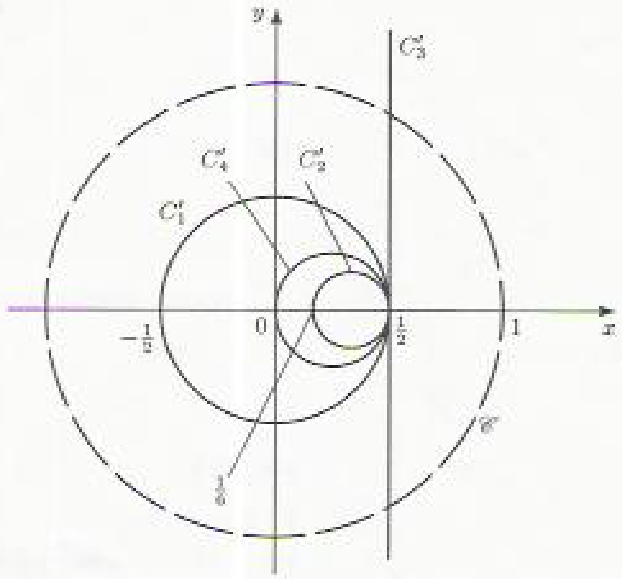

1A for C_1'
$1\frac{1}{2}$A for C_2'
$1\frac{1}{2}$A for C_3'
1A for C_4'

Question 12

We seek a matrix associated with the projective transformation t.

Let $\mathbf{A}$ be the matrix

$$\begin{pmatrix} 0 & v & w \\ 0 & 0 & w \\ u & 0 & w \end{pmatrix}$$

$\frac{1}{2}$M, $\frac{1}{2}$A for form of matrix

where none of u, v or w is zero. We must choose u, v and w such that

$$\begin{pmatrix} 0 & v & w \\ 0 & 0 & w \\ u & 0 & w \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix};$$

1M

that is,

$$\begin{pmatrix} v+w \\ w \\ u+w \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix}.$$

$\frac{1}{2}$M, $\frac{1}{2}$A Expressing this as simultaneous equations is fine too.

It follows from the second row that $w = 2$; then, by comparing the other two rows, we deduce that $v = 1$ and $u = -1$. 1A

Thus a matrix associated with t is

$$\mathbf{A} = \begin{pmatrix} 0 & 1 & 2 \\ 0 & 0 & 2 \\ -1 & 0 & 2 \end{pmatrix}.$$

1A for answer

Question 13

Let $u = \log_e x$, so that $x = e^u$. Then 1M

$$\frac{du}{dx} = \frac{1}{x}, \qquad \text{so} \quad du = \frac{dx}{x}.$$

Alternatively, check that the derivative of $x \longmapsto -3(\log_e x)^{-1/3}$ is $x \longmapsto 1/x(\log_e x)^{4/3}$.