## Financial Mathematics Principal component analysis

0035-1.
Let $e_{1}, e_{2}, e_{3}$ be the standard basis of $\mathbb{R}^{1 \times 3}$,

$$
\begin{array}{ll}
\text { viz., } & e_{1}:=\left[\begin{array}{lll}
1 & 0 & 0
\end{array}\right] \\
& e_{2}:=\left[\begin{array}{lll}
0 & 1 & 0
\end{array}\right], \\
& e_{3}:=\left[\begin{array}{lll}
0 & 0 & 1
\end{array}\right] .
\end{array}
$$

a. Let $v_{1}:=\left[\begin{array}{lll}2 & 4 & -2\end{array}\right]$,

Let $v_{2}:=\left[\begin{array}{lll}1 & -1 & -1\end{array}\right]$.
Find a rotation matrix $R$
and scalars $c_{1}, c_{2} \in \mathbb{R}$
such that $c_{1} e_{1} R=v_{1}$ and $c_{2} e_{2} R=v_{2}$.
b. Find a rotation matrix $L$ such that $v_{1} L \in \mathbb{R} e_{1}$ and $v_{2} L \in \mathbb{R} e_{2}$.

0035-2. Let $M:=\left[\begin{array}{lll}1 & 2 & 0 \\ 2 & 0 & 2\end{array}\right]$.
Find rotation matrices

$$
\begin{aligned}
& K \in \mathbb{R}^{2 \times 2} \text { and } L \in \mathbb{R}^{3 \times 3} \\
& \text { s.t. } K M L \text { is "diagonal". }
\end{aligned}
$$

