Let $U$ be the basis for $\mathbb{R}^2$ given by $u_1 = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$, $u_2 = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$. Let $V$ be the basis for $\mathbb{R}^2$ given by $v_1 = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$, $v_2 = \begin{pmatrix} 9 \\ 2 \end{pmatrix}$.

1. Find the change of basis matrix from $U$ coordinates to $V$ coordinates.

2. If $w \in \mathbb{R}^2$ and $[w]_U = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$, find $[w]_V$ and $[w]_E$ where $E$ is the standard basis for $\mathbb{R}^2$. Be sure to indicate which is which.

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1 This is partly to ensure that everyone is taking this exam with equivalent resources.