We must first simplify the equations for the two orthogonal vectors.

$$-\vec{e_1} + 2\vec{e_2} + k\vec{e_3} = -\begin{bmatrix}1\\0\\0\end{bmatrix} + 2\begin{bmatrix}0\\1\\0\end{bmatrix} + k\begin{bmatrix}0\\0\\1\end{bmatrix} = \begin{bmatrix}-1\\2\\k\end{bmatrix}$$

$$-\vec{e_1} + k\vec{e_2} + 2\vec{e_3} = -\begin{bmatrix}1\\0\\0\end{bmatrix} + k\begin{bmatrix}0\\1\\0\end{bmatrix} + 2\begin{bmatrix}0\\0\\1\end{bmatrix} = \begin{bmatrix}-1\\k\\2\end{bmatrix}$$

We know that because the vectors are orthogonal, their dot product must be equal to zero. From that we can create the following equation and solve.

$$\begin{bmatrix}-1\\2\\k\end{bmatrix} \cdot \begin{bmatrix}-1\\k\\2\end{bmatrix} = 0$$

$$(-1)\cdot(-1) + 2\cdot k + k\cdot 2 = 0$$

$$1 + 4k = 0$$

$$k = -\frac{1}{4}$$

Therefore, the only real number value for k that allows the vectors to be orthogonal is $-\frac{1}{4}$.