Step-1

Two vectors *x* and *y* are orthogonal if $x^T y = 0$

Let $\alpha = (1,4),\ \beta = (2,-2)$

$$\begin{vmatrix} 1 & 2 \\ 4 & -2 \end{vmatrix} = -2-8$$

$$= -10$$
$$\neq 0$$

Therefore the vectors α, β are linearly independent.

Also, $\alpha^T \beta = \begin{bmatrix} 1 & 4 \end{bmatrix} \begin{bmatrix} 2 \\ -2 \end{bmatrix}$

$$= 2-8$$
$$= -6$$
$$\neq 0$$

So, $\alpha = (1,4),\ \beta = (2,-2)$ are not orthogonal.

Therefore, $\alpha = (1,4),\ \beta = (2,-2)$ are linearly independent vectors in R^2 are not orthogonal.

Step-2

On the other hand, suppose $a = (1,0),\ b = (0,0)$

$$a^T b = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$
$$= 0+0$$
$$= 0$$

Therefore the vectors a, b are orthogonal.

Also, $\begin{vmatrix} 1 & 0 \\ 0 & 0 \end{vmatrix}$

$$= 0-0$$
$$= 0$$

Therefore, the set of orthogonal vectors in R^2 are not linearly independent.