Assume $U = \{ (x,y) \in \mathbb{R}^2 \mid x, y \in \mathbb{Z} \}$

- U is closed under addition

  $a = (x_1, y_1), \ b = (x_2, y_2) \in U \quad x_1, x_2, y_1, y_2 \in \mathbb{Z}$

  $a + b = (x_1 + x_2, y_1 + y_2)$

  $x_1 + x_2, \ y_1 + y_2 \in \mathbb{Z}, \ \forall \ x_1, x_2, y_1, y_2 \in \mathbb{Z} \Rightarrow$

  $\Rightarrow a + b \in U, \ \forall \ a, b \in U$

- U is closed under taking additive inverses.

  $a = (x_1, y_1) \in U, \ x_1, y_1 \in \mathbb{Z}$

  $-a = (-x_1, -y_1)$

  $-x_1, -y_1 \in \mathbb{Z}, \ \forall \ x_1, y_1 \in \mathbb{Z} \Rightarrow$

  $\Rightarrow -a \in U \quad \forall \ a \in U.$

However, U is not closed under scalar multiplication

Assume $a = (1,1) \in U, \ \alpha = \frac{1}{2} \in \mathbb{R}.$

$\alpha a = \frac{1}{2}(1,1) = \left(\frac{1}{2}, \frac{1}{2}\right) \notin U \ \left(\frac{1}{2} \notin \mathbb{Z}\right)$

So, if U is a non-empty subset of $\mathbb{R}^2$ closed under addition and taking additive inverses it does not imply it's a subspace of $\mathbb{R}^2$.