Step-1

Suppose $v=(x,y)$, then we know that the reflection of the point (x,y) across the *x*-axis is given by the following matrix multiplication:

$$\begin{bmatrix}1 & 0\\ 0 & -1\end{bmatrix}\begin{bmatrix}x\\ y\end{bmatrix}=\begin{bmatrix}v_1\\ v_2\end{bmatrix}$$

So, we get

$$T=\begin{bmatrix}1 & 0\\ 0 & -1\end{bmatrix}$$

Step-2

or $T(v)=(x,-y)$

Step-3

Let $v=(x,y)$, then we know that the reflection of the point (x,y) across the *y*-axis is given by the following matrix multiplication:

$$\begin{bmatrix}-1 & 0\\ 0 & 1\end{bmatrix}\begin{bmatrix}x\\ y\end{bmatrix}=\begin{bmatrix}v_1\\ v_2\end{bmatrix}$$

So, we get

$$S=\begin{bmatrix}1 & 0\\ 0 & -1\end{bmatrix}$$

or

$$S(v)=(-x,y)$$

Step-4

To find $S(T(v))$, we have

$$
\begin{aligned}
S(T(v)) &= ST(v) \\
&= \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} \\
&= \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} \\
&= \begin{bmatrix} -x \\ -y \end{bmatrix}
\end{aligned}
$$

Step-5

Therefore,

Step-6

$S(T(v)) = \boxed{(-x, -y)}$

Step-7

We know that the reflection of the point (x, y) about the origin is given by the following matrix multiplication:

$$
\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} v_1 \\ v_2 \end{bmatrix}
$$

Therefore, $\boxed{\text{the product } ST \text{ is the reflection of the point } (x, y) \text{ about the origin}}$.