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**Quiz for April 5, 2011**

Let  $T: \mathbb{R}^2 \rightarrow \mathbb{R}^3$  be a linear transformation such that  $T\left(\begin{bmatrix} 1 \\ 0 \end{bmatrix}\right) = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$

and  $T\left(\begin{bmatrix} 0 \\ 1 \end{bmatrix}\right) = \begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}$ . Find  $T\left(\begin{bmatrix} 3 \\ 2 \end{bmatrix}\right)$ . Explain what you are doing VERY thoroughly. Write in complete sentences.

**Answer:** We see that  $\begin{bmatrix} 3 \\ 2 \end{bmatrix} = 3\begin{bmatrix} 1 \\ 0 \end{bmatrix} + 2\begin{bmatrix} 0 \\ 1 \end{bmatrix}$ . We use the fact that  $T$  is a linear transformation to see that

$$T\left(\begin{bmatrix} 3 \\ 2 \end{bmatrix}\right) = T\left(3\begin{bmatrix} 1 \\ 0 \end{bmatrix} + 2\begin{bmatrix} 0 \\ 1 \end{bmatrix}\right) = 3T\left(\begin{bmatrix} 1 \\ 0 \end{bmatrix}\right) + 2T\left(\begin{bmatrix} 0 \\ 1 \end{bmatrix}\right) = 3\begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} + 2\begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}$$

$$= \boxed{\begin{bmatrix} 7 \\ 2 \\ -3 \end{bmatrix}}.$$