(Q8)

(a) $\{(x, mx)|x \in \mathbb{R}\}$ and $\{(x, -\frac{1}{m}x)|x \in \mathbb{R}\}$.
$y = -\frac{1}{m}x$ is orthogonal to $y = mx$, so any reflection across the latter of any element in $y = -\frac{1}{m}$ would still lie on the same line.

(b)

Proof. By earlier proof, T is an isomorphism, so $N(T) = \{0_{\mathbb{R}^3}\}$. Then $T(N(T)) = N(T)$ by linearity, so $N(T)$ is T-invariant.
Since T is isomorphic,

$$\operatorname{rank} T = \dim T = \dim(\operatorname{im} T) = n \implies \operatorname{im} T = \mathbb{R}^3 \subseteq \mathbb{R}^3$$

■