Here's a (slightly generalized) version of problem 2.5.4.

Let $S \subseteq k[x_1, \ldots, x_n]$ be a subset (not necessarily an ideal) and define

$$\begin{aligned} \mathrm{LT}(S) &= \{\mathrm{LT}(f) \mid f \in S \setminus \{0\}\} \\ \mathrm{LM}(S) &= \{\mathrm{LM}(f) \mid f \in S \setminus \{0\}\} \end{aligned}$$

Then $\langle \mathrm{LM}(S) \rangle = \langle \mathrm{LT}(S) \rangle$.

Proof. Suppose $f \in S \setminus \{0\}$. If $\mathrm{LM}(f) = x^\alpha$, then $\mathrm{LT}(f) = cx^\alpha$ for some nonzero $c \in k$. This means that

$$\mathrm{LT}(f) = c \cdot \mathrm{LM}(f) \in \langle \mathrm{LM}(S) \rangle$$

so $\langle \mathrm{LT}(S) \rangle \subseteq \langle \mathrm{LM}(S) \rangle$. Conversely, note that

$$\mathrm{LM}(f) = c^{-1}\mathrm{LT}(f) \in \langle \mathrm{LT}(S) \rangle$$

so $\langle \mathrm{LM}(S) \rangle \subseteq \langle \mathrm{LT}(S) \rangle$. $\square$