Section 2.

1. $T=\begin{bmatrix}\lambda & 0\\ 0 & \lambda\end{bmatrix}$, $\lambda \in R/\{0\}$

2. Let $g(x)=3x^TAx$, $f(g(x))=2\sin(g(x))$.

$$\nabla_x f(x)=\frac{df}{dg}\frac{dg}{dx}=2\cos(3x^TAx)\cdot 3(A+A^T)x$$

$$=6\cos(3x^TAx)(A+A^T)x.$$