General rules:

1. Compute the Fourier coefficients of the AND function $f : \{0, 1\}^n \to \{0, 1\}$ defined as $f(x) = 1$ if and only if $x = \vec{1}$.

2. Compute the Fourier coefficients of the PARITY function $f : \{0, 1\}^n \to \{0, 1\}$ defined as $f(x) = x_1 + \ldots + x_n \mod 2$.

3. Compute the Fourier coefficients of the inner product function $f : \{0, 1\}^2 \to \{-1, 1\}$ defined as $f(x) = (-1)^{x_1 x_2 + x_3 x_4 + \ldots + x_{2n-1} x_{2n}}$.

4. Let $f : \{0, 1\}^n \to \mathbb{R}$ be computed by a decision tree of height $k$. That is every internal node of the tree is labeled with one of the variables, and the leaves are labeled with real numbers. The value of $f(x)$ is the the label of the leaf obtained by traversing the path from the root to a leaf determined by the value of the variables on the path (Let’s say $x_i = 1$ means moving to the left child, and $x_i = 0$ means moving to the right child). Prove that $\hat{f}(S) = 0$ if $|S| > k$. 