Problem 1) The function $\alpha f(\alpha x) = \alpha/\cosh(\pi\alpha x)$, where $\alpha > 0$ is an arbitrary real-valued parameter, is a scaled version of $f(x)$. The scaling theorem of Fourier transform shows that this function is transformed to $F(s/\alpha) = 1/\cosh(\pi s/\alpha)$. The area under $\alpha f(\alpha x)$ is given by its Fourier transform $F(s/\alpha)$ at $s = 0$; that is $\int_{-\infty}^{\infty} \alpha f(\alpha x)\mathrm{d}x = 1/\cosh(0) = 1$.

As $\alpha \to \infty$, the height of $\alpha f(\alpha x)$, namely, $\alpha f(0) = \alpha$, goes to infinity, while its width shrinks toward zero, but the function remains symmetric, and its area remains constant at 1. This means that $\alpha f(\alpha x)$ approaches $\delta(x)$ in the limit when $\alpha \to \infty$. In the same limit, $F(s/\alpha)$ retains its height of 1, while its width expands to infinity; in other words, $F(s/\alpha) \to 1$ when $\alpha \to \infty$. We conclude that the Fourier transform of $g(x) = \delta(x)$ is $G(s) = 1$.