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Solutions of Exercise Sheet 7: Fourier Transforms

Exercise 1 *(Fourier Transforms)*

It follows by calculation, that the structure of the Gaussian functions g is invariant under Fourier transform, whereas the Fourier transform of the box function is given by $\hat{b}(\omega) = \mathsf{sin}(\pi\omega)/(\pi\omega) =: \mathsf{sinc}(\omega)$.

Exercise 2 *(Gábor Transform)*

The statements follow easily by calculation.

Exercise 3 *(FFT Big Oh Time Complexity, 6 Points)*

Iterative substation into $T(n) = 2 \cdot T(n/2) + \mathcal{O}(n)$ leads with $T(1) \in \mathcal{O}(1)$ to the time complexity of $\mathcal{O}(N \log N)$ for a given input signal of length N. Alternatively, this follows directly by the application of the Master theorem.