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Assignment Nr. 6

6.1 Duality of Multiplication and Convolution

6.2 Fourier Transformation

$$\begin{aligned}
B(k) &= \int_{-\infty}^{\infty} b(x)e^{-2\pi ikx}dx \\
&= \int_{-1}^{1} e^{-2\pi ikx}dx \\
&= \int_{-1}^{1} cos(-2\pi kx) + i \cdot sin(-2\pi kx)dx \\
&= [\frac{1}{-2\pi k} sin(-2\pi kx) + i \cdot \frac{1}{-2\pi k}(-cos(-2\pi kx))]_{-1}^{1} \\
&= [\frac{1}{-2\pi k}(sin(-2\pi kx) - i \cdot cos(-2\pi kx))]_{-1}^{1} \\
&= \frac{1}{-2\pi k}\Big(\big(sin(-2\pi k) - i \cdot cos(-2\pi k)\big) - \big(sin(2\pi k) - i \cdot cos(2\pi k)\big)\Big) \\
&= \frac{1}{-2\pi k}\Big(sin(-2\pi k) - i \cdot cos(-2\pi k) - sin(2\pi k) + i \cdot cos(2\pi k)\Big) \\
&= \frac{1}{-2\pi k}\Big(sin(-2\pi k) - sin(2\pi k)\Big) \\
&= \frac{1}{-2\pi k}\Big(2sin(\frac{-2\pi k - 2\pi k}{2})\Big) \\
&= \frac{1}{-2\pi k}\Big(2sin(-2\pi k)\Big) \\
&= \frac{sin(-2\pi k)}{-\pi k}
\end{aligned}$$