DARA Training 2024
Lecture - The Fourier Transform

Mr. J. Heystek Grobler

Outline

Introduction

The Fourier Transform

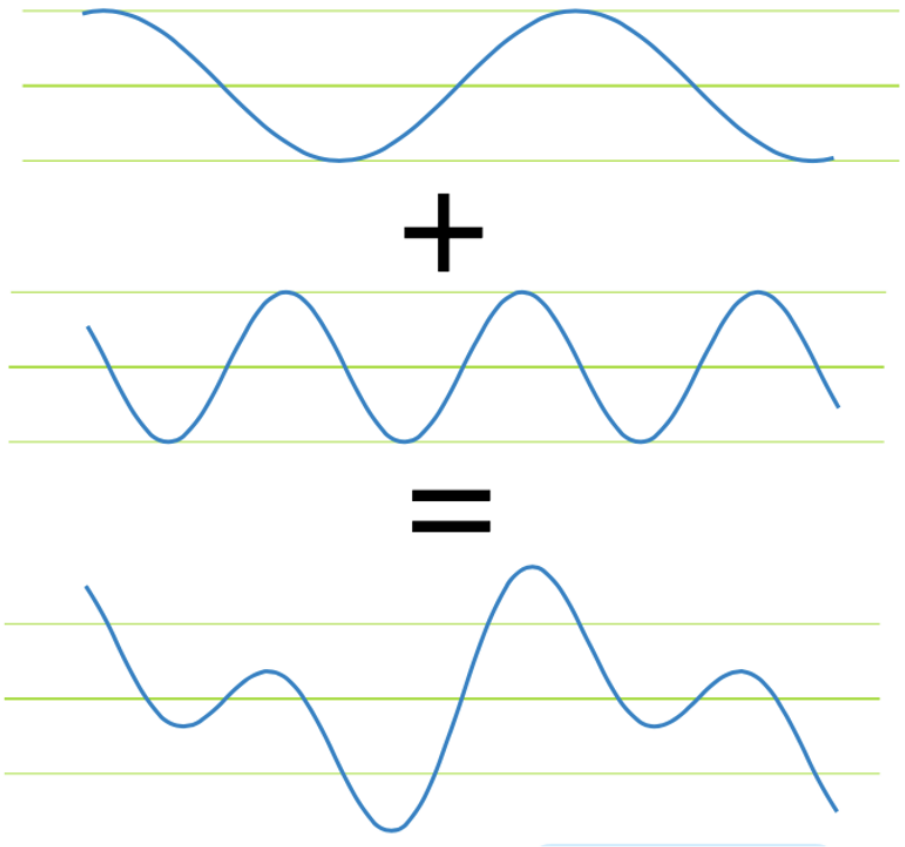
Questions

- What is the Fourier Transform?

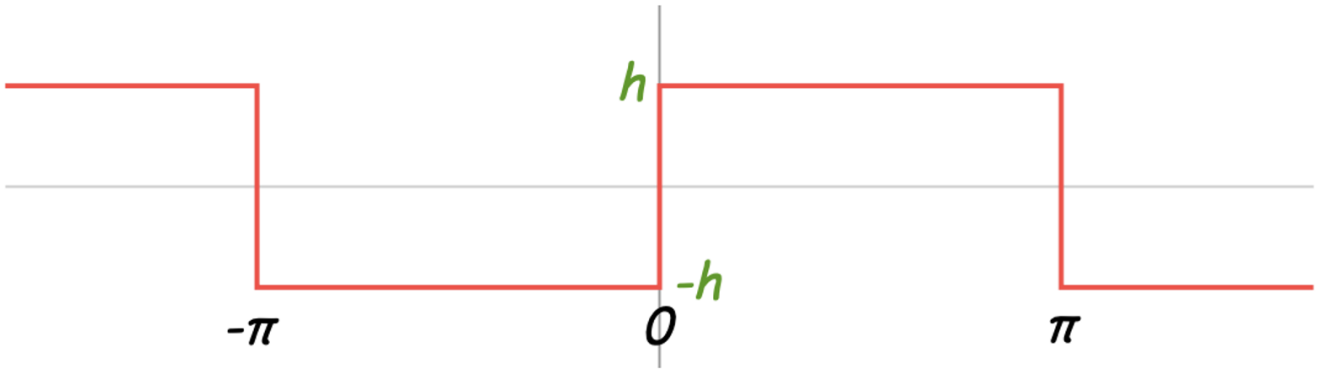
The Fourier Transform is important in mathematics, engineering, and the physical sciences. The Discrete Fourier Transform (DFT) which is computed by making use of the Fast Fourier Transform (FFT) has changed modern society, since it is used in digital electronics and signal processing.

Radio Astronomers are keen users of the Fourier Transform because it is a key component in data and signal processing.

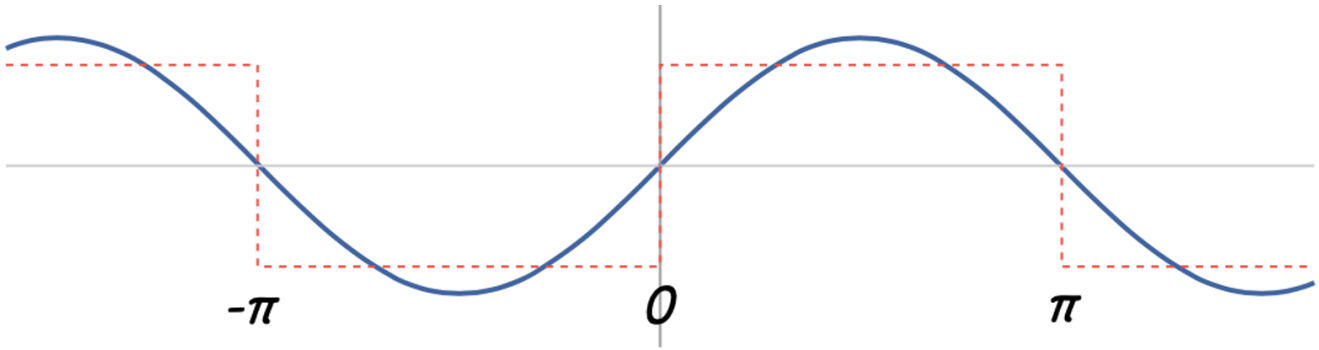
- We can add sine waves together to form a new sine wave.



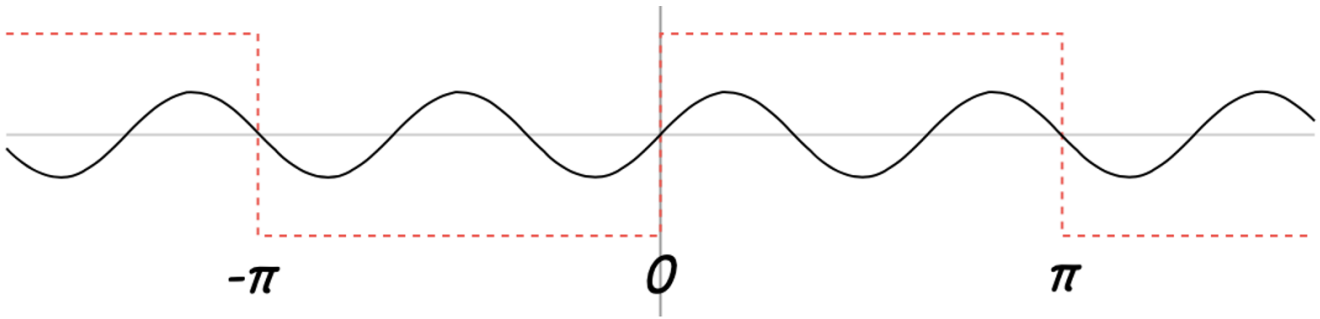
- We want to add together sine waves to create a square wave.



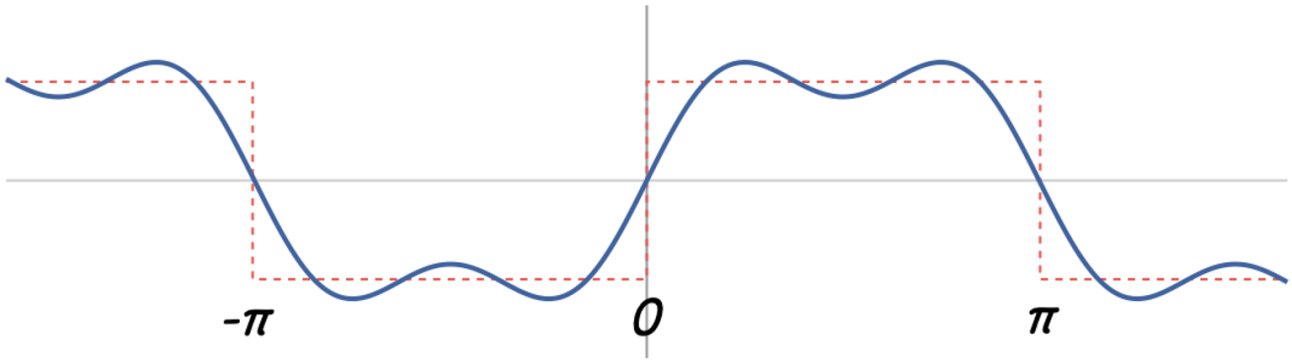
- We start with $sin(x)$.



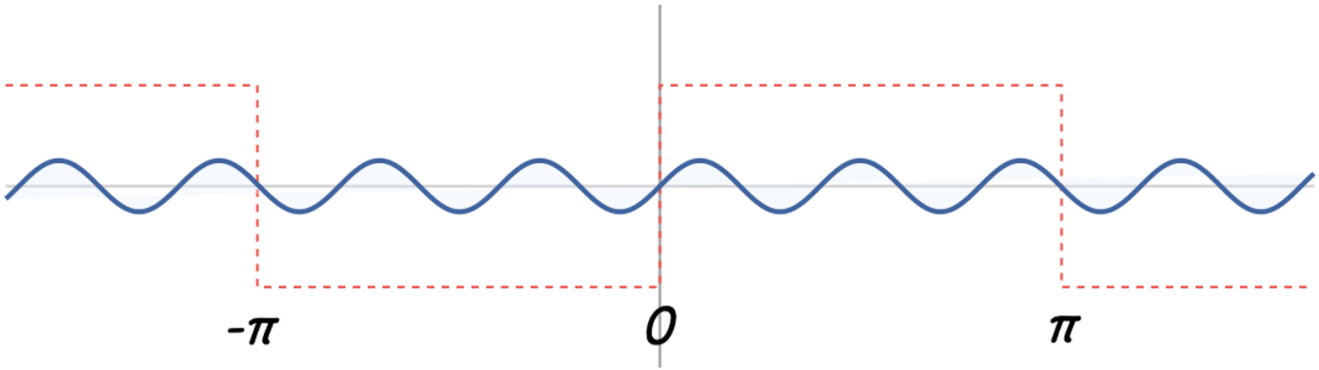
- Then we lake $sin\frac{(3x)}{3}$.



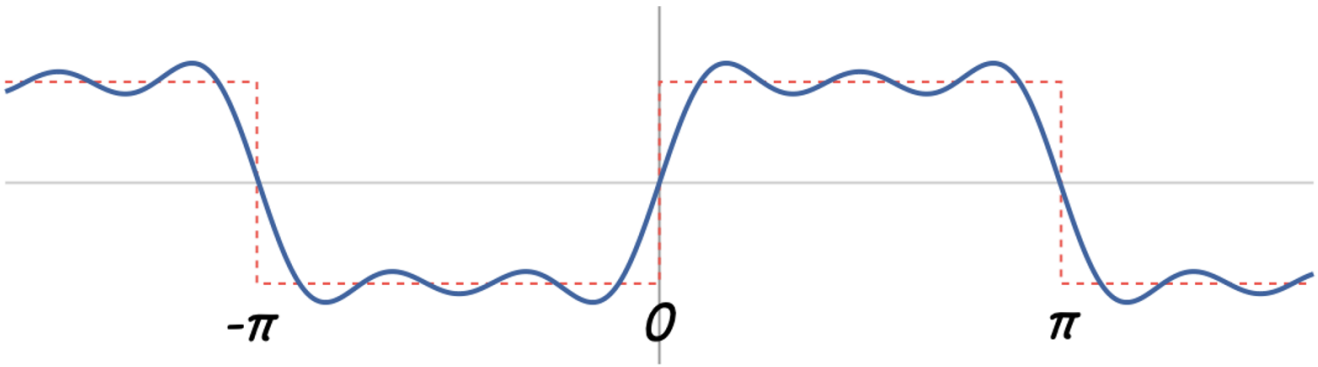
- Now we add $sin(x)$ and $sin\frac{(3x)}{3}$.



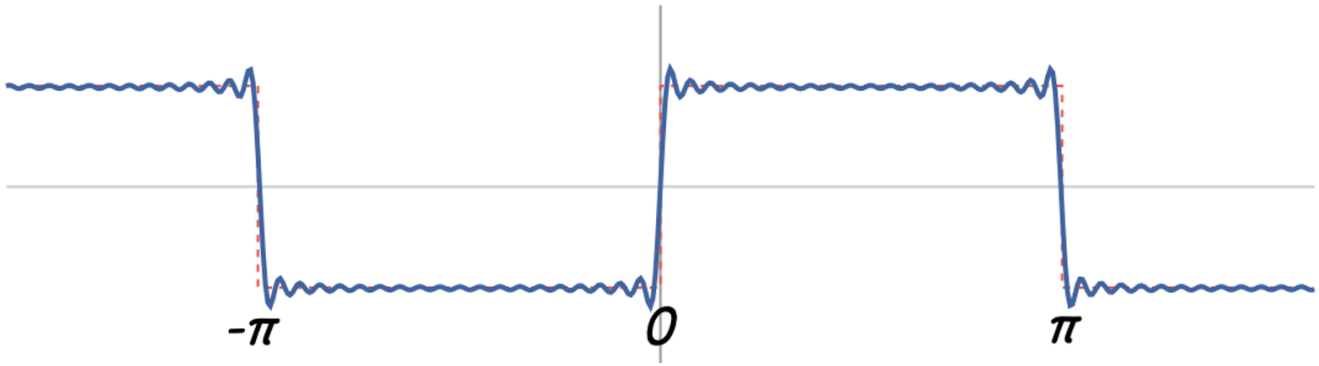
- Now we use $sin\frac{(5x)}{5}$.



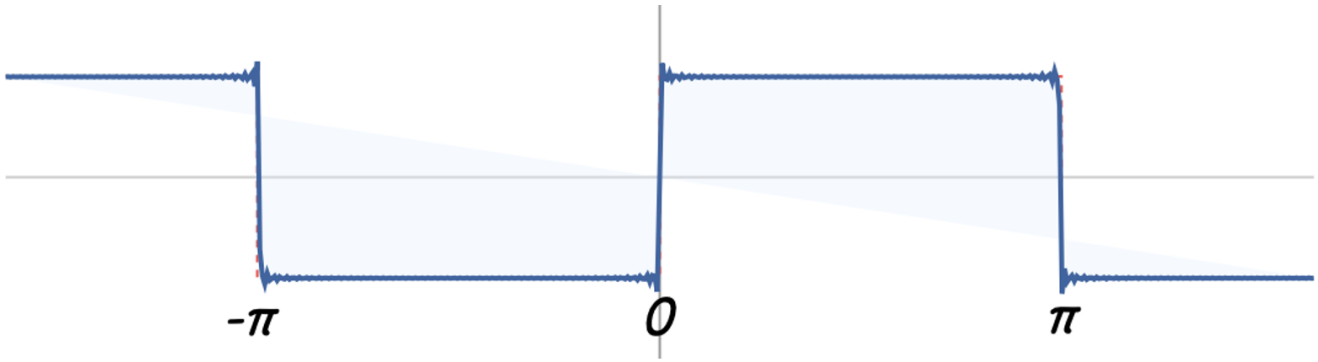
- Now we add $sin(x)$ and $sin\frac{(3x)}{3}$ as weel as $sin\frac{(5x)}{5}$.



- When we add 20 sine waves together we get.

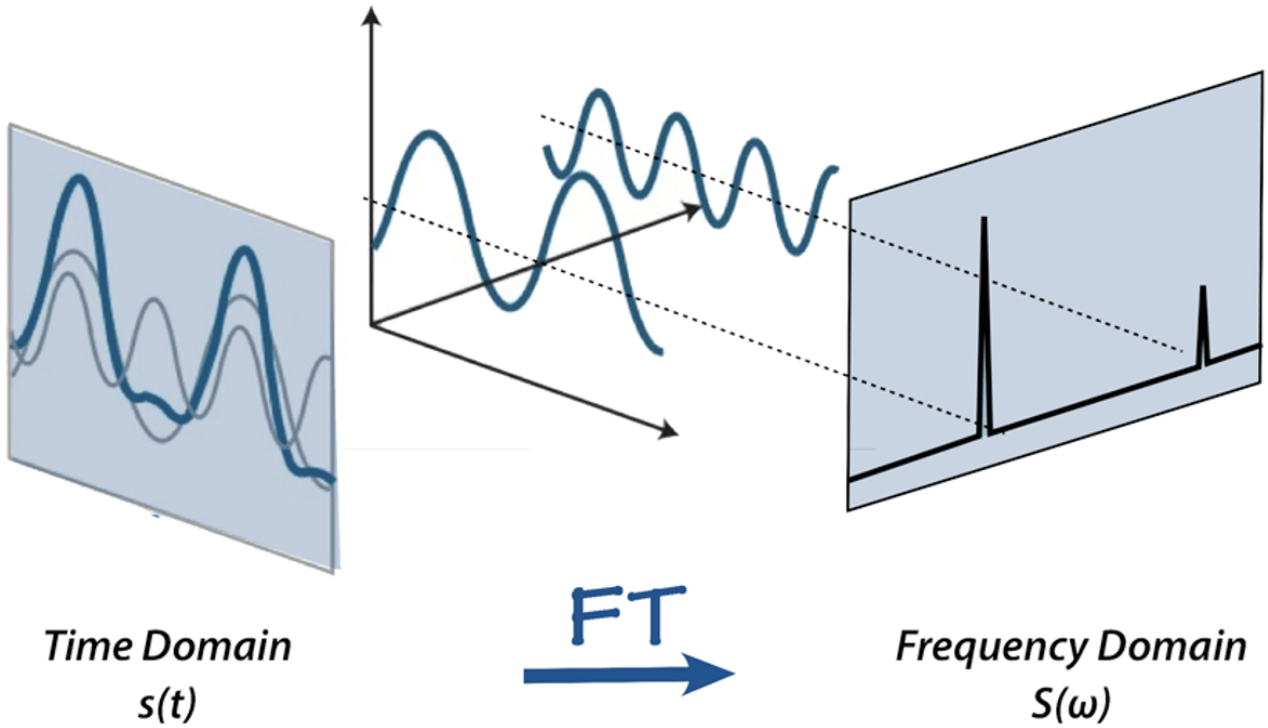


- When we add 100 sine waves together we get.



The Fourier Transform

- The Fast Fourier Transform (FFT).



- The Fourier Equation.

$$F(s) \equiv \int_{-\infty}^{\infty} f(x)\, e^{-2\pi i s x}\, dx \ ,$$

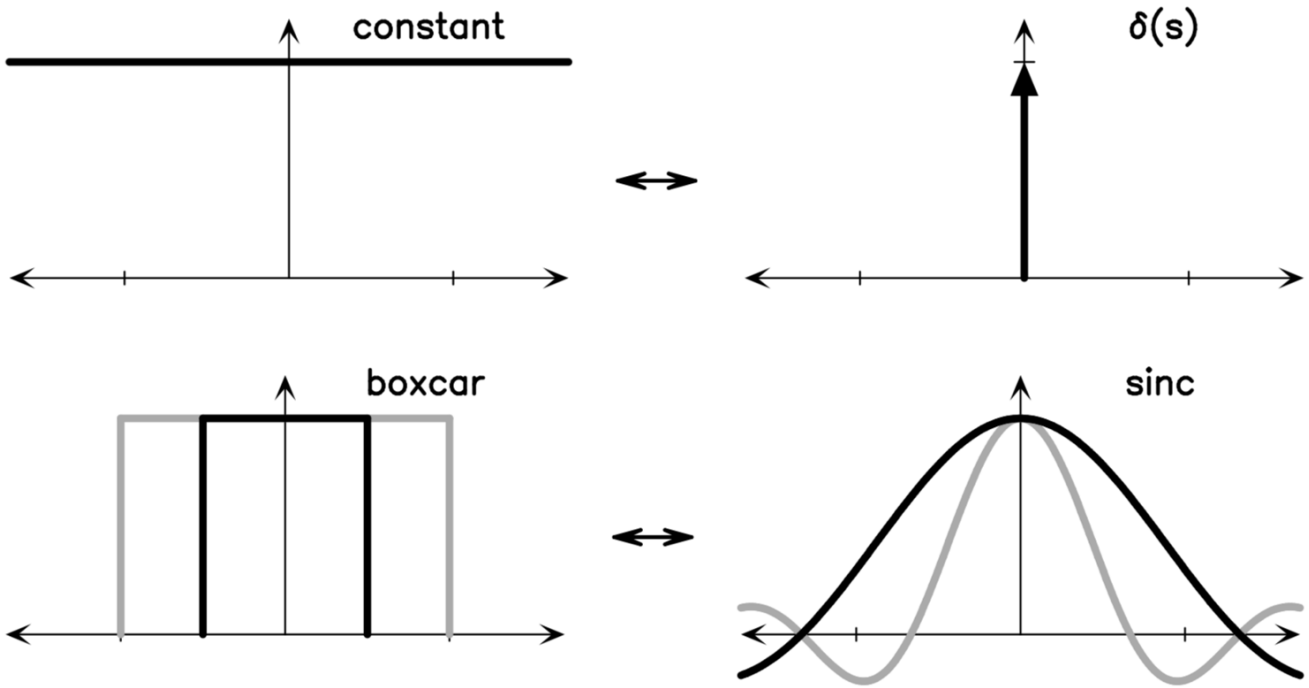
- The Inverse Fourier Transform Equation.

$$f(x) \equiv \int_{-\infty}^{\infty} F(s)\, e^{2\pi i s x}\, ds\ ,$$

- Euler's Formula.

$$e^{i\phi} = \cos\phi + i\sin\phi,$$

- Basic Fourier Transforms.



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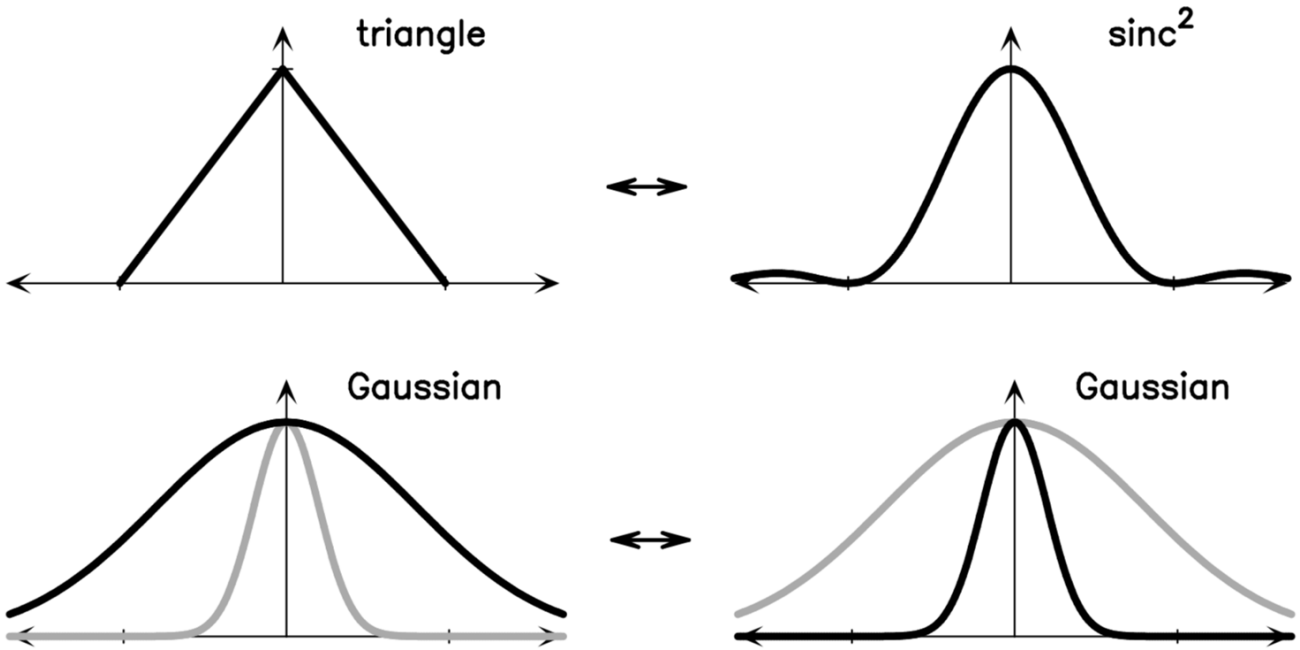

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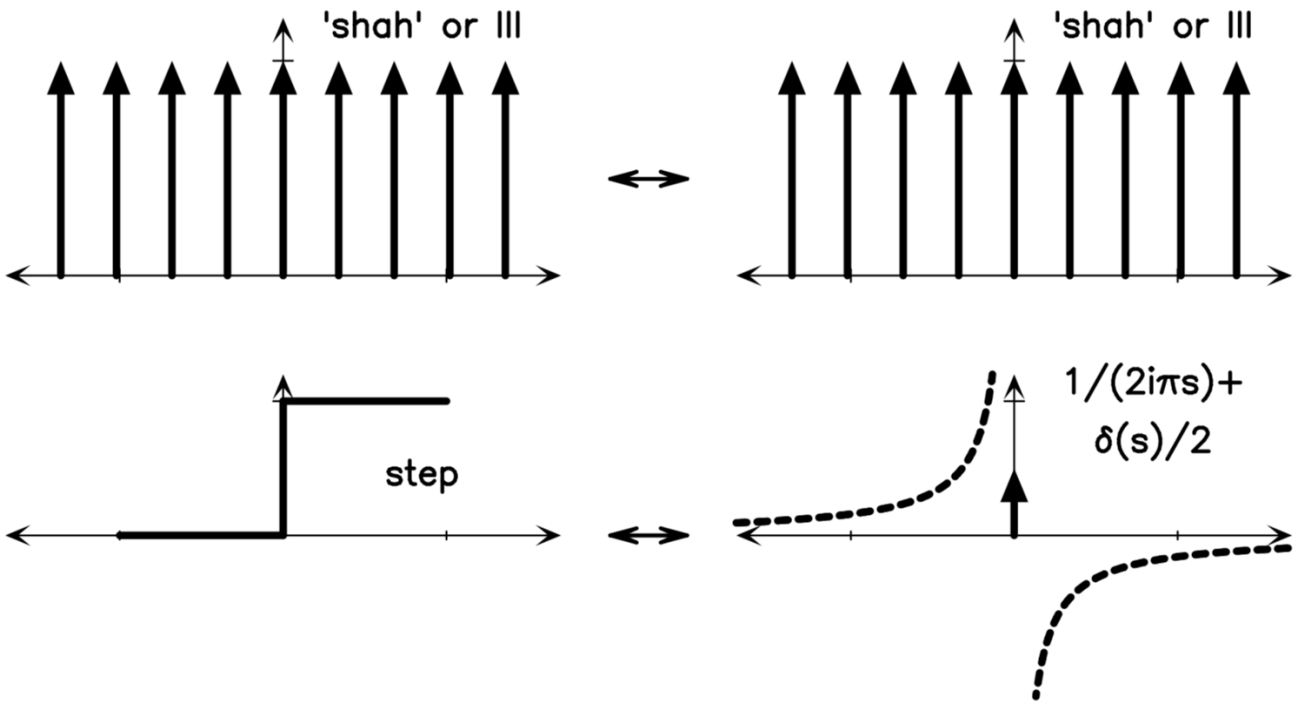

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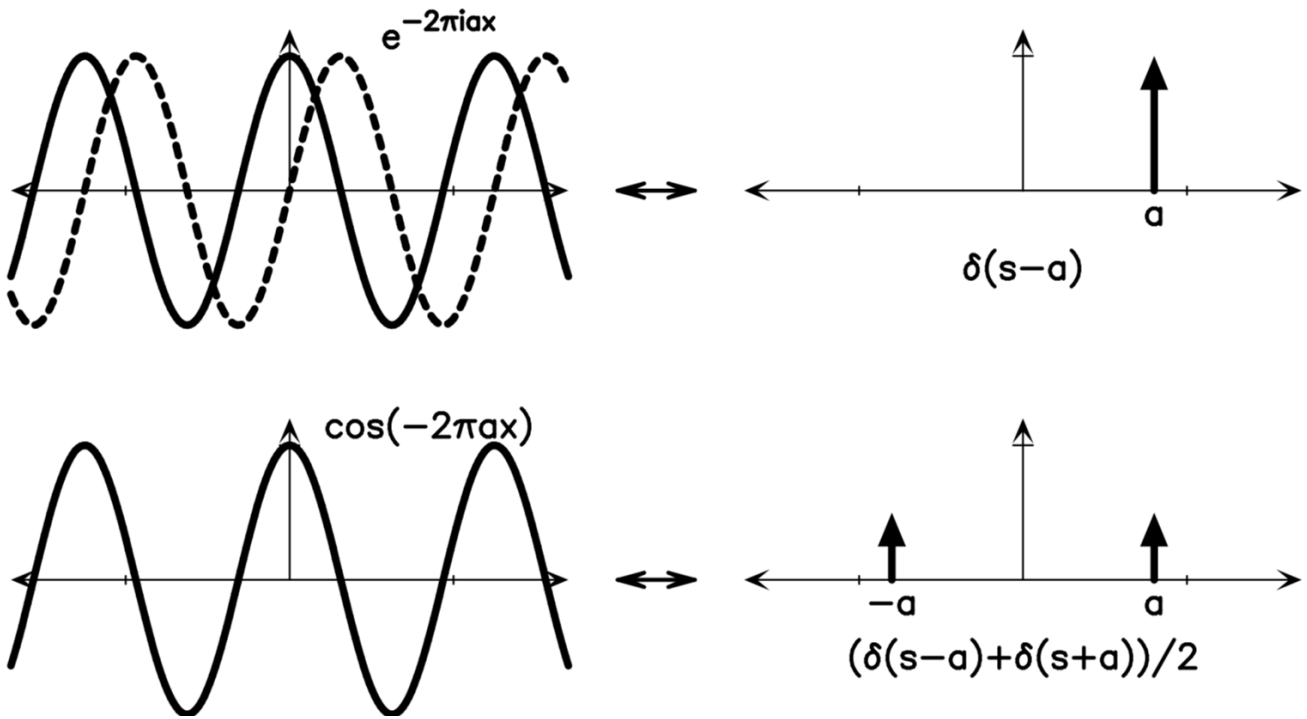

Questions