sinc and jinc-functions

The lateral beam profile from 1D linear and a rectangular transducers are given by the sinc-funtio, defined by

$$\mathrm{sinc}(x) = \frac{\sin(\pi x)}{\pi x} \, . \tag{1}$$

The lateral beam profile from a circular transducer is given by a similar function, where the sine function is replaced by a Bessel function. This function is often denoted jinc and is defined by

$$\mathrm{jinc}(x) = \frac{2J_1(\pi x)}{\pi x} \tag{2}$$

where $J_1(x)$ is the Bessel function of the fist kind and order one. Note that different definitions for the sinc- and jinc-functions can be foundin the literature , e.g., without the π and the factor 2.

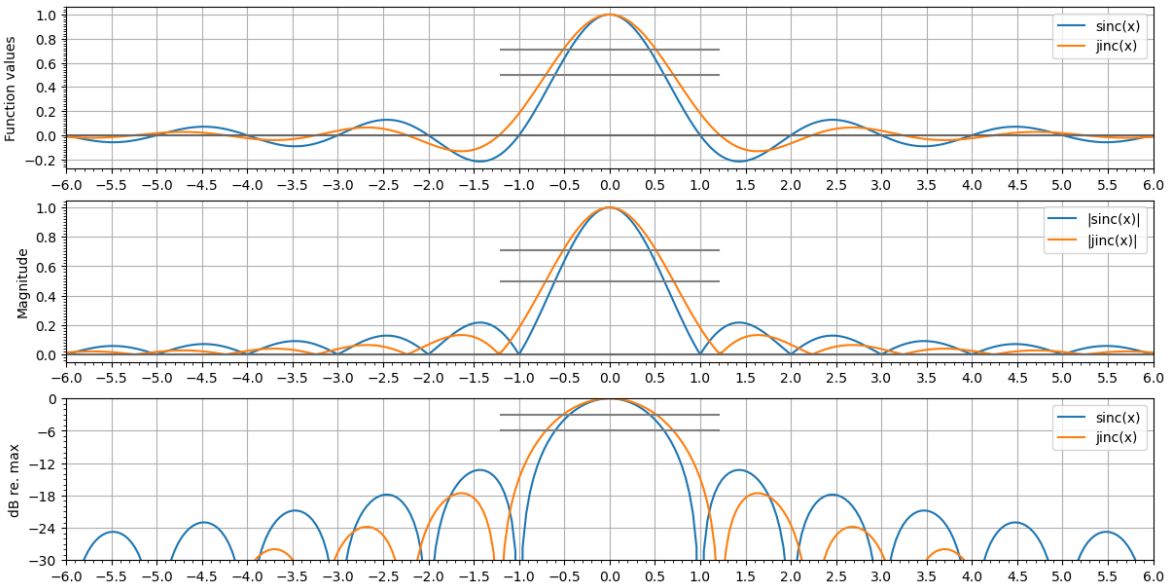
Both the sinc and jinc function share the same behavior, a central peak around $x = 0$, the main lobe, and an oscaillation pattern with peaks and zeros, where the amplitude decays as we move away from zero. The main difference that the main lobe of the jinc is slightly wider than the main lobe of the sinc, and that the peaks of the jinc are somewhat lower then those of the sinc. For the trasnducer beam profiles, this can be interpreted as a an apodisation, the circular aperture has lower side lobes and broader main lobe than the rectangular aperture due to the roundtded off edges.

The shapes of the sinc and jinc functions are shown below, together with reference values for the -3 dB and -6 dB limits, the first zero, and the first sidelobe.

In [5]:
```
import sinc_jinc
sinc_jinc.plot()
```

```
Reference values
Value          sinc   jinc
0.000          1.000  1.220
0.500  -6 dB   0.603  0.705
0.707  -3 dB   0.443  0.514

Sidelobes  x      f(x)
sinc(x)    1.440  -0.217
jinc(x)    1.640  -0.132
```


Function values
sinc(x)
jinc(x)
Magnitude
|sinc(x)|
|jinc(x)|
dB re. max
sinc(x)
jinc(x)

In [ ]: