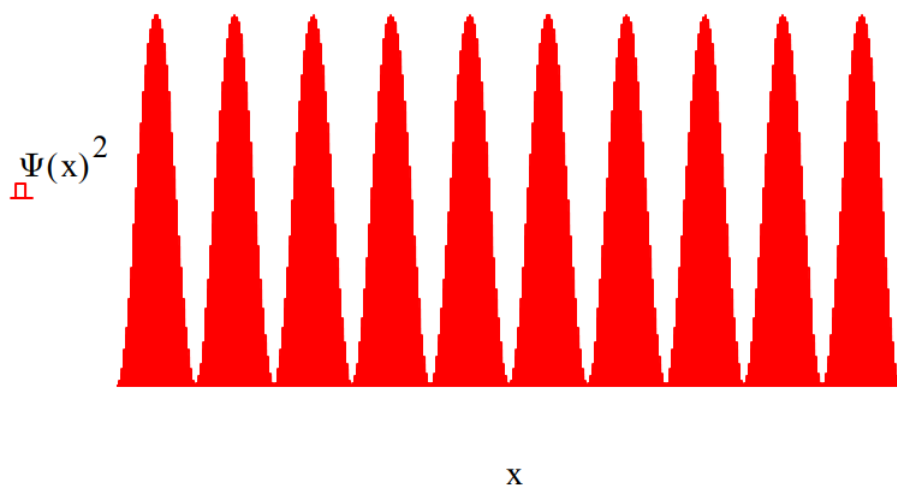


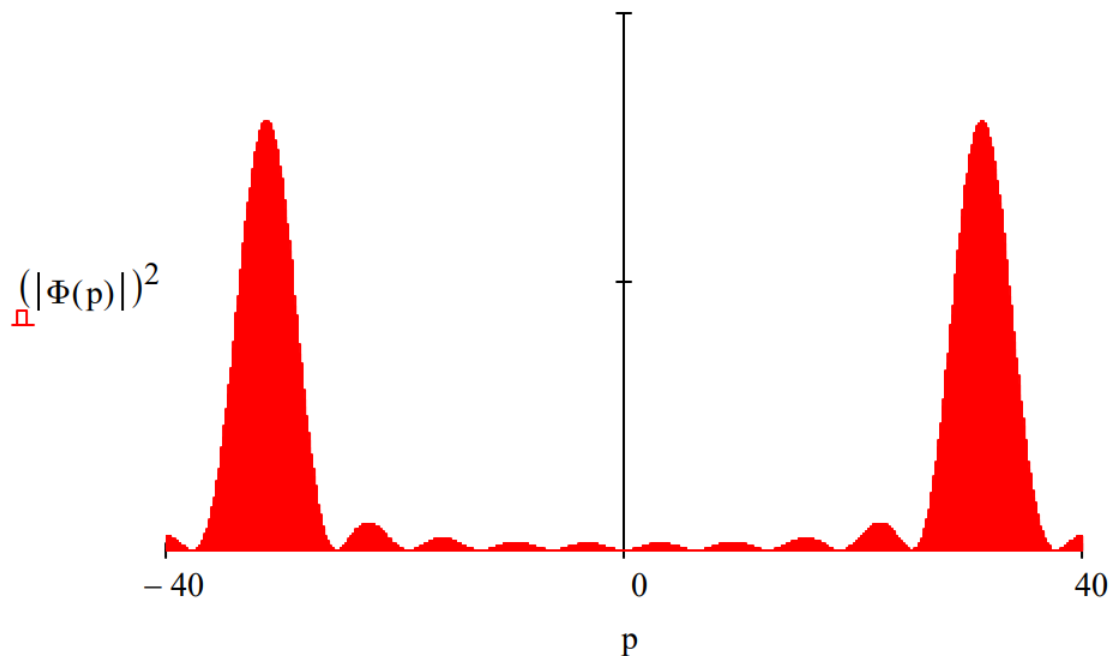
1.71: The Wigner Distribution for a Particle in a One-dimensional Box

The following outlines the calculation of the Wigner distribution for a particle in a one-dimensional box for the $n = 10$ state. First the coordinate wave function is Fourier transformed into momentum space. Following that the Wigner function is calculated using the momentum space wave function.

$$\Psi(x) := \sqrt{2} \cdot \sin(10 \cdot \pi \cdot x)$$



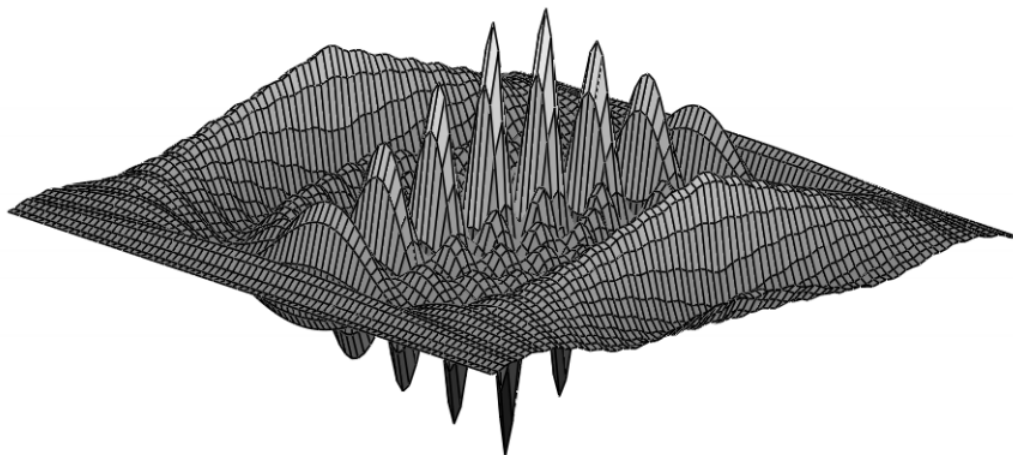
$$\Phi(p) := \frac{1}{\sqrt{2 \cdot \pi}} \cdot \int_0^1 \exp(-i \cdot p \cdot r) \cdot \Psi(x) dx \text{ simplify } \rightarrow -\frac{10 \cdot \sqrt{\pi} \cdot (e^{-p \cdot i} - 1)}{100 \cdot \pi^2 - p^2}$$



$$W(x, p) := \frac{1}{2 \cdot \pi} \cdot \int_{-\infty}^{\infty} \overline{\Phi\left(p + \frac{s}{2}\right)} \cdot \exp(-i \cdot s \cdot x) \cdot \Phi\left(p - \frac{s}{2}\right) ds$$

$$N := 80 \quad i := 0 \dots N \quad x_i := \frac{i}{N}$$

$$j := 0 \dots N \quad p_j := -40 + \frac{80 \cdot j}{N} \quad \text{Wigner}_{i,j} := W(x_i, p_j)$$



Wigner

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