Question:

The wavefunction for a particle is defined by:

$\psi(x) = \{$ N cos($2\pi x/L$) for - L/4 $\leq x \leq$ L/4

0 otherwise

Determine

i) the normalization constant N, and

ii) the probability that the particle will be found between x = 0 and x = L / 8. (5+5)

Solution:

By entering t = 2x + 0.5L, we get its range [0;L] and the wavefunction $\psi(t)$= N sin($\pi t/L$). In this case

$$N = \sqrt{\frac{2}{L}}$$ and   the   probability

$$p = \frac{0.75L - 0.5L}{L} - \frac{\sin 2\pi \cdot 0.75 - \sin 2\pi \cdot 0.5}{6.28} = 0.25 + 0.16 = 0.41$$

The answer:

The normalization constant $N = \sqrt{\frac{2}{L}}$

The probability p = 0.41