A particle is described by the wavefunction:

\[ \Psi(x) = \begin{cases} 
\frac{2}{\sqrt{L}} \cos\left(\frac{2\pi x}{L}\right), & \text{for } -\frac{L}{4} \leq x \leq \frac{L}{4} \\
0, & \text{otherwise}
\end{cases} \]  

You may find this trig identity useful:

\[ \cos^2(\theta) = \frac{1 + \cos(2\theta)}{2} \]

(a) Sketch the space dependence of this wavefunction.

(b) What is the probability that the particle will be found between \( x = 0 \) and \( x = L/8 \)?

\[ P = \int_0^{L/8} \left( \frac{4}{L} \cos^2\left(\frac{2\pi x}{L}\right) \right) dx = \frac{4}{2L} \int_0^{L/8} \left( 1 + \cos\left(\frac{4\pi x}{L}\right) \right) dx \]

\[ = \frac{2}{L} \left[ x + \frac{L}{4\pi} \sin\left(\frac{4\pi x}{L}\right) \right]_0^{L/8} \]

\[ = \frac{2}{L} \left[ \frac{L}{8} + \frac{L}{4\pi} \sin\left(\frac{4\pi}{2}\right) - 0 - \frac{L}{4\pi} \sin(0) \right] \]

\[ = \frac{2}{L} \left[ \frac{L}{8} + \frac{L}{4\pi} \right] \]

\[ = \frac{1}{4} + \frac{1}{2\pi} \approx 0.517. \]