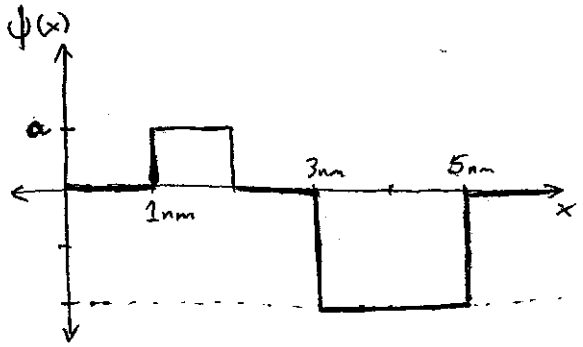
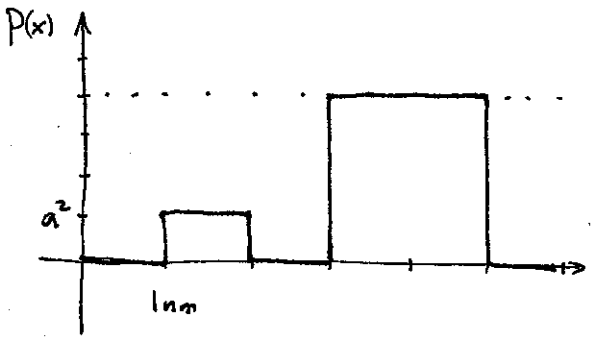
Question 1



a) The plot at the left shows the wavefunction for an electron in a thin wire. On another graph, sketch the probability density for finding the electron. ★ Have $P(x) = |\psi(x)|^2$ ★



We want $\int_{-\infty}^{\infty} dx\, P(x) = 1$ so:

$$9\,nm \cdot a^2 = 1$$

$$\Rightarrow a = \frac{1}{3\,nm^{1/2}}$$

b) For this wavefunction, what is the probability that we will find the electron between 1*nm* and 2*nm* in a measurement? What is the probability that we'll find it between 3*nm* and 5nm? *(Hint: how can we figure out the value of a?)*

$$P_{1<x<2} = \int_{1nm}^{2nm} dx\, P(x) = \int_{1nm}^{2nm} dx \cdot \frac{1}{9nm} = \frac{1}{9}$$

$$P_{3<x<5} = \int_{3nm}^{5nm} dx\, P(x) = \int_{3nm}^{5nm} dx\, \frac{1}{9nm} = \frac{8}{9}$$

or: area of big box is 8 x area of small box ∴

$$P_{1<x<2} = \frac{1}{8} P_{3<x<5}$$

But $P_{1<x<2} + P_{3<x<5} = 1$

so $P_{1<x<2} = \frac{1}{9}$

c) On the original diagram, sketch a possible wavefunction for the electron immediately after we make a measurement of position.