**Example-** Let's examine the various quantities related to putting an electron in an infinite potential well that is 4 Angstroms wide.

**Define some constants**

$h := 6.62607015\cdot 10^{-34}$ J-s    $hmod := \frac{h}{2\cdot\pi}$    $hmod = 1.05457\times 10^{-34}$ J-s

$m := 9.1093837015\cdot 10^{-31}$ kg    $a := 4\cdot 10^{-10}$ m

**Calculate some quantities and/or define equations**

Per (2.33), the wave number (rad/m), in terms of quantum number *n*, is    $k(n) := \frac{n\cdot\pi}{a}$

Per (2.35)    $A2 := \sqrt{\frac{2}{a}}$    $\boxed{A2 = 7.071\times 10^{4}}$ $m^{-0.5}$

Per (2.38), the quantized energy (J & eV), in terms of quantum number *n*, is

$$E(n) := \frac{hmod^{2}\cdot n^{2}\cdot\pi^{2}}{2\cdot m\cdot a^{2}} \qquad EeV(n) := \frac{E(n)}{1.602176634\cdot 10^{-19}}$$

Per (2.39), the wave function ($m^{-0.5}$), in terms of quantum number *n* and position *x*, is

$$\psi(n,x) := A2\cdot\sin(k(n)\cdot x)$$

Per (2.17), the probability density function ($m^{-1}$), in terms of quantum number *n* and position *x*, is

$$\Psi2(n,x) := \psi(n,x)\cdot\overline{\psi(n,x)}$$

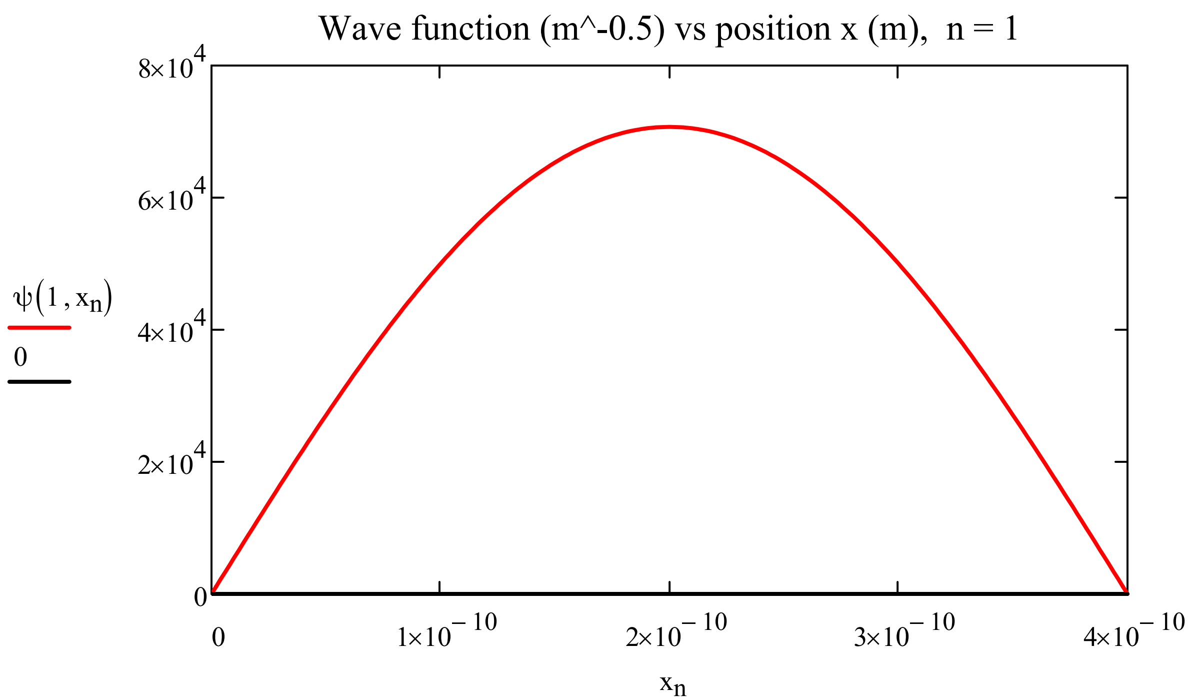
Define a vector of positions *x* across the width of the potential well, i.e., $0 <= x <= a$.

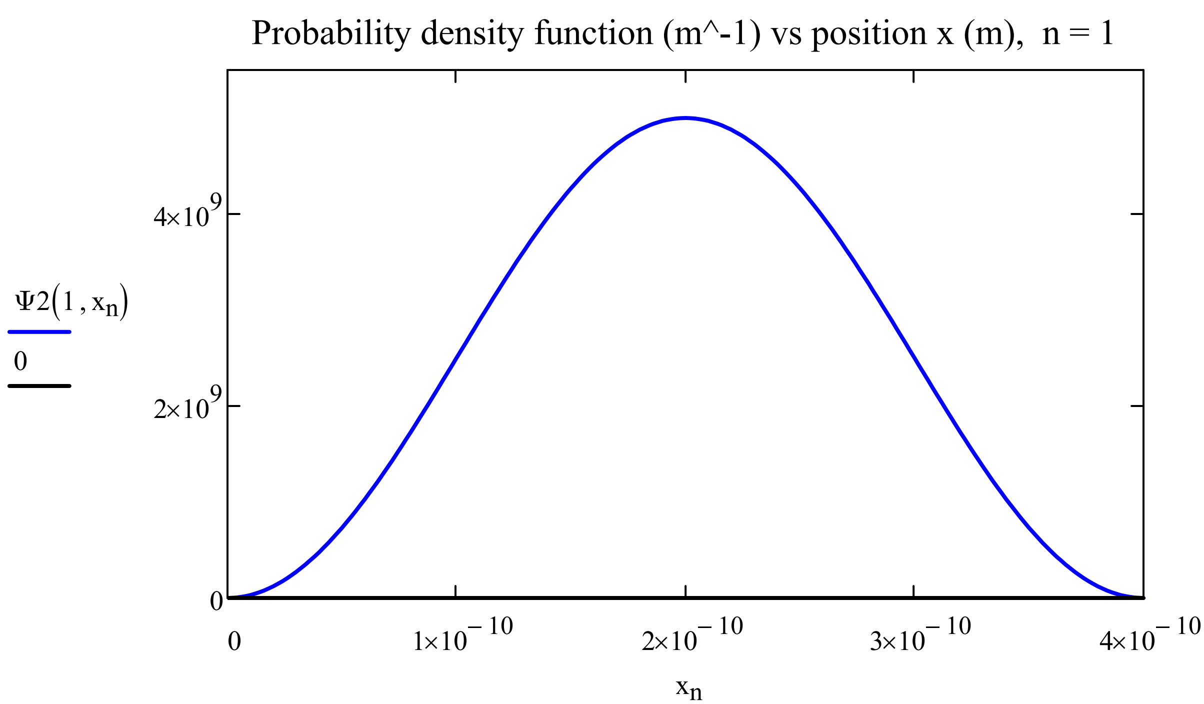
$Nmax := 200$    $n := 0..Nmax$    $x_n := \frac{n}{Nmax}\cdot a$

**For the first quantum level, i.e., *n* = 1**

$k(1) = 7.854 \times 10^{9}$ (rad/m)

$E(1) = 3.765 \times 10^{-19}$ (J) or $EeV(1) = 2.3502$ (eV)



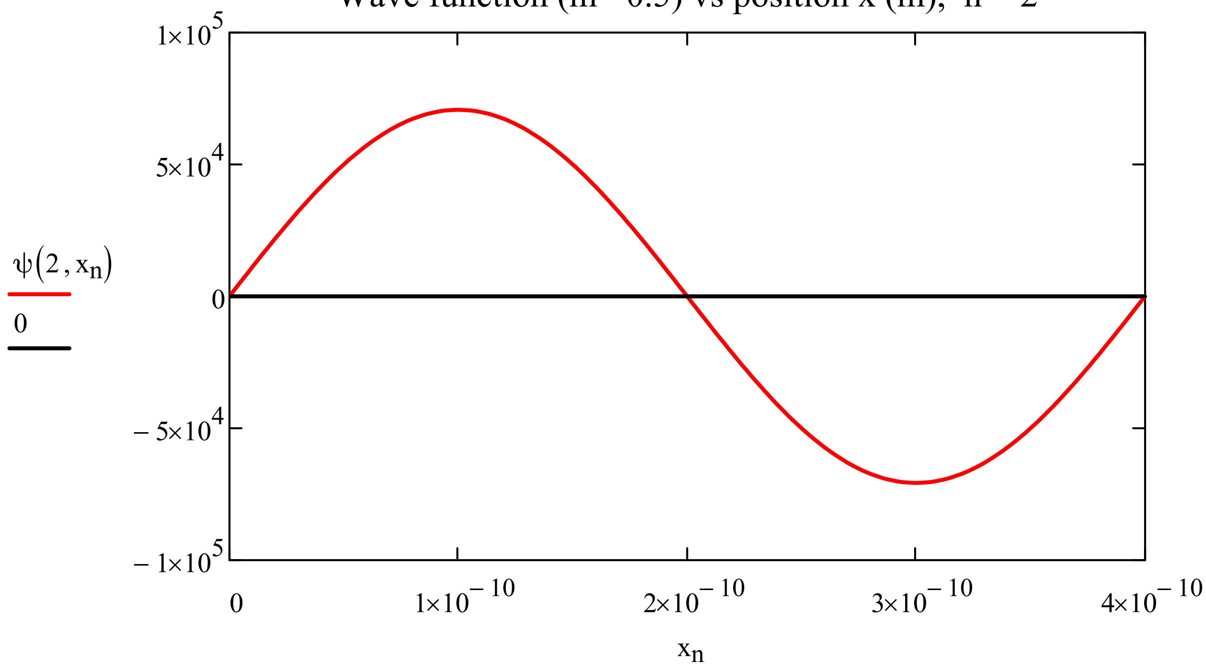



## For the second quantum level, i.e., $n = 2$

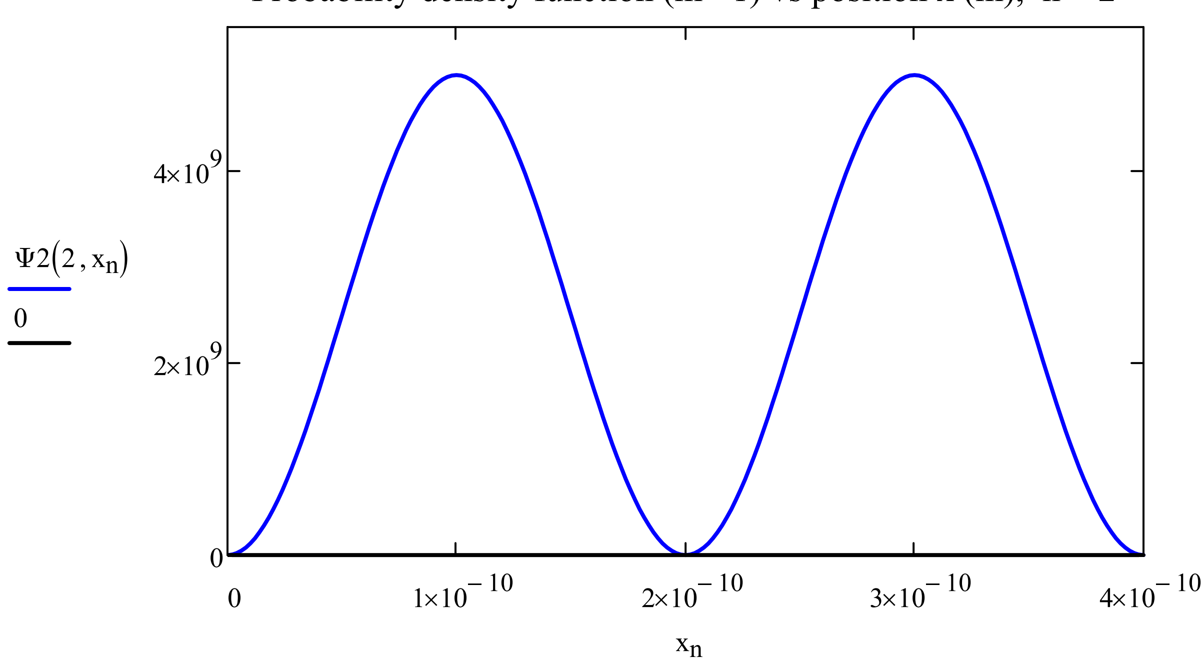
$$k(2) = 1.5708 \times 10^{10} \quad \text{(rad/m)}$$

$$E(2) = 1.506 \times 10^{-18} \quad \text{(J) or} \quad EeV(2) = 9.4008 \quad \text{(eV)} \qquad \frac{EeV(2)}{EeV(1)} = 4$$

Wave function (m^-0.5) vs position x (m),  n = 2




Probability density function (m^-1) vs position x (m),  n = 2

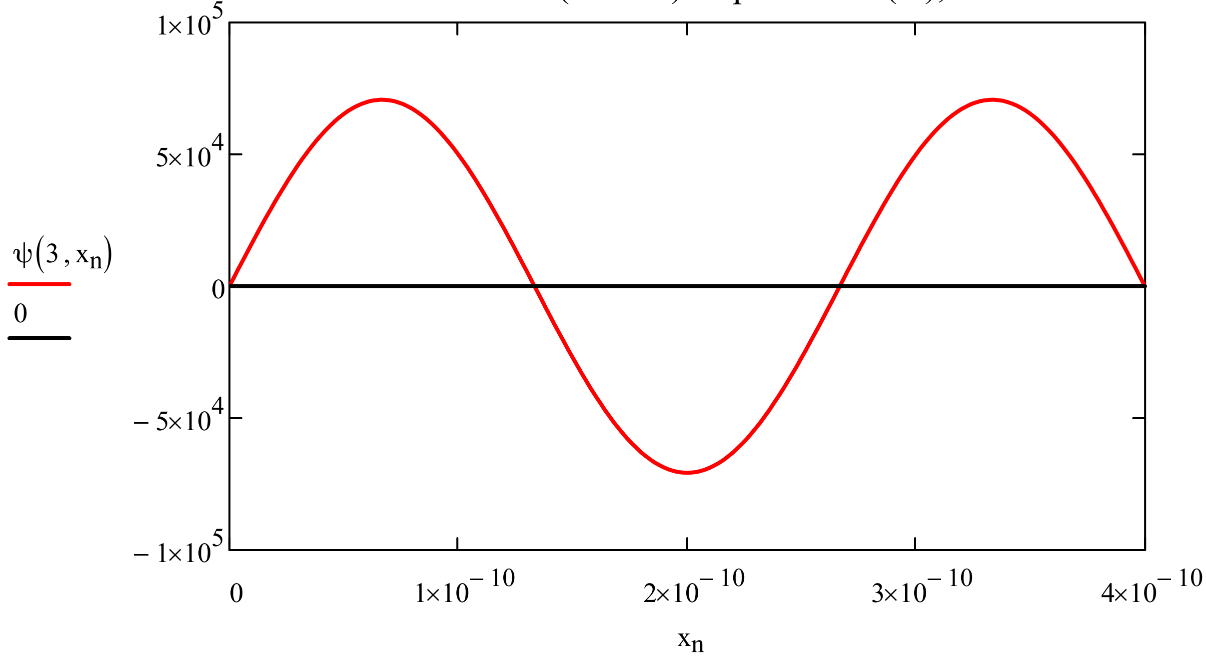


## For the third quantum level, i.e., $n = 3$

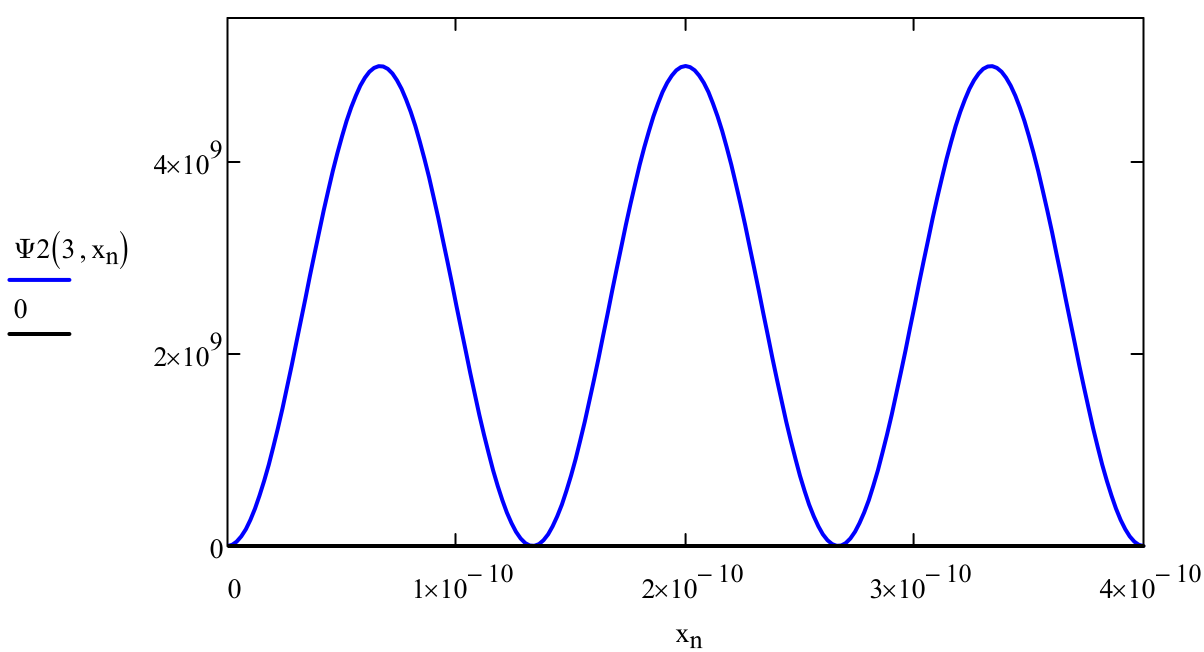
$$k(3) = 2.3562 \times 10^{10} \quad \text{(rad/m)}$$

$$E(3) = 3.389 \times 10^{-18} \text{ (J) or } EeV(3) = 21.1517 \text{ (eV)} \qquad \frac{EeV(3)}{EeV(1)} = 9$$

Wave function (m^-0.5) vs position x (m), n = 3



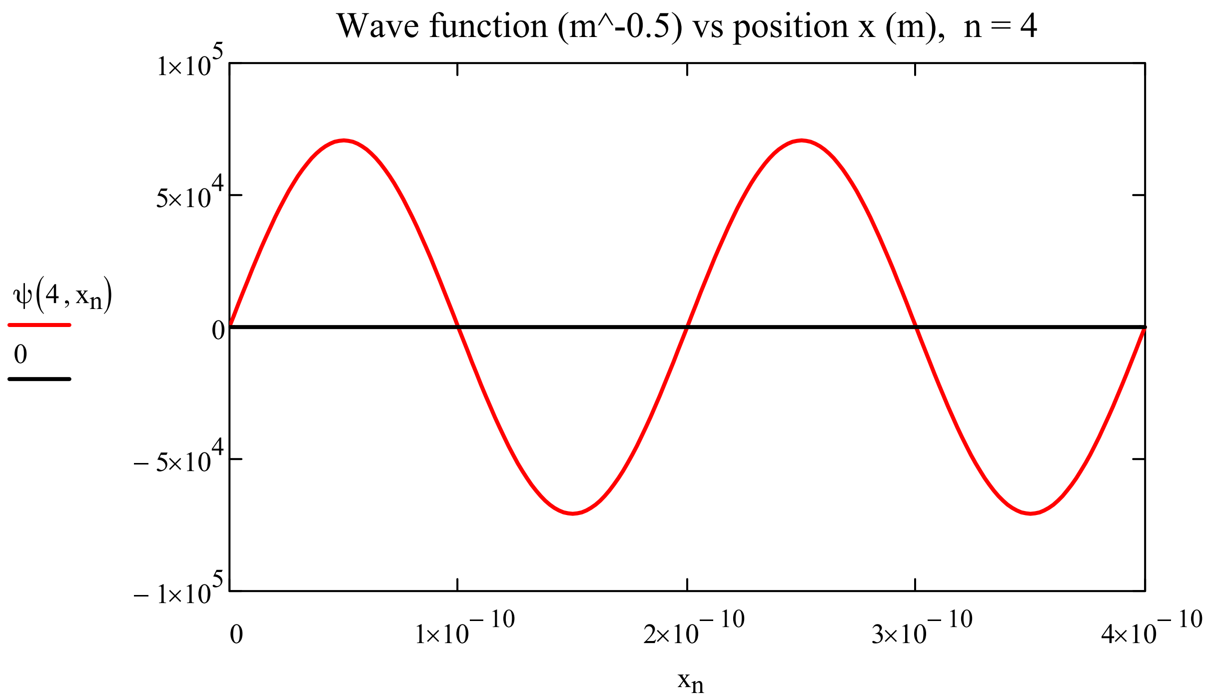

Probability density function (m^-1) vs position x (m), n = 3

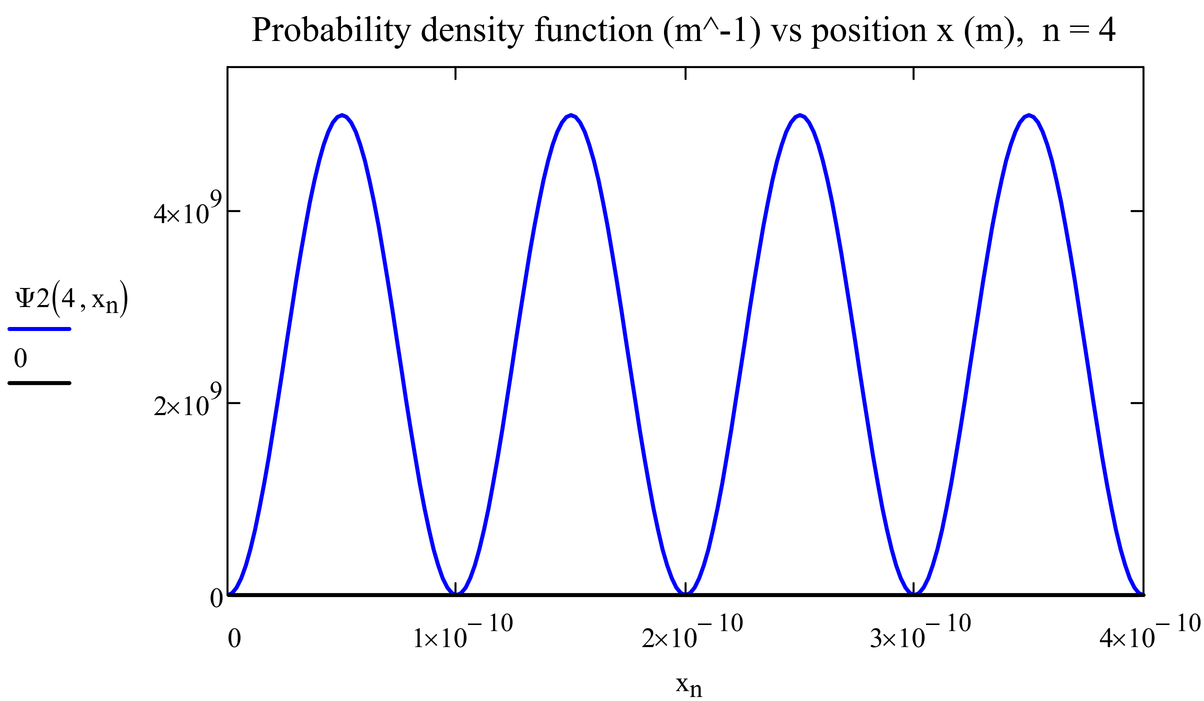


**For the fourth quantum level, i.e., *n* = 4**

$k(4) = 3.1416 \times 10^{10}$ (rad/m)

$E(4) = 6.025 \times 10^{-18}$ (J) or $EeV(4) = 37.603$ (eV) $\frac{EeV(4)}{EeV(1)} = 16$



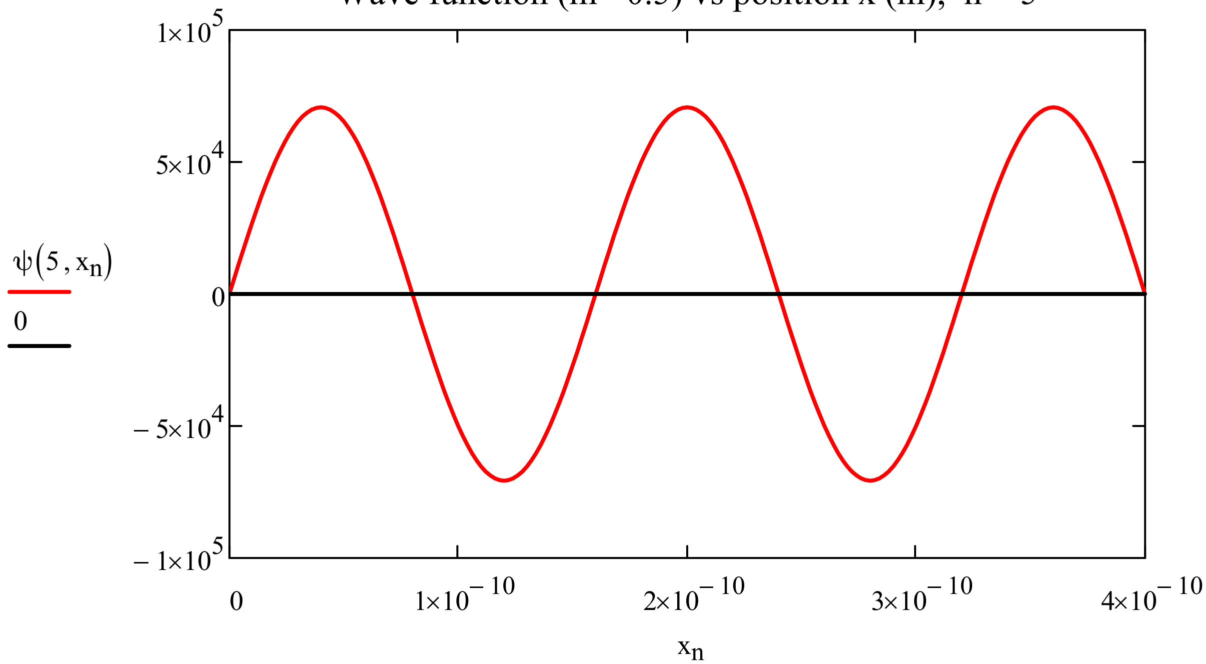



**For the fifth quantum level, i.e., *n* = 5**

$k(5) = 3.927 \times 10^{10}$ (rad/m)

$E(5) = 9.414 \times 10^{-18}$ (J) or $EeV(5) = 58.7547$ (eV) $\frac{EeV(5)}{EeV(1)} = 25$

Wave function (m^-0.5) vs position x (m), n = 5




Probability density function (m^-1) vs position x (m), n = 5