$$U(r) = K\left[\left(\frac{\sigma}{r}\right)^{12} - \left(\frac{\sigma}{r}\right)^{6}\right]$$

$$U(r) = \left[\left(\frac{1}{r}\right)^{12} - \left(\frac{1}{r}\right)^{6}\right]$$

$$f(x) = f(x_0) + (x-x_0)\frac{df}{dx}|_{x_0} + \frac{1}{2}(x-x_0)^2\frac{d^2f}{dx^2}|_{x_0} + \frac{1}{6}(x-x_0)^3\frac{d^3f}{dx^3}|_{x_0} + ...$$

$$f(x) = f(x_0) + \sum_{n=1}^{\infty}\frac{1}{n!}(x-x_0)^n\frac{d^nf}{dx^n}|_{x_0}$$

$$f(x) = f(x_0) + 0 + \frac{1}{2}(x-x_0)^2\frac{d^2f}{dx^2}|_{x_0} + \frac{1}{6}(x-x_0)^3\frac{d^3f}{dx^3}|_{x_0} + ...$$

$$f(x) \simeq f(x_0) + \frac{1}{2}(x-x_0)^2\frac{d^2f}{dx^2}|_{x_0} + ...$$

$$f(x) \simeq f(x_0) + \left[\frac{1}{2}\frac{d^2f}{dx^2}|_{x_0}\right](x-x_0)^2$$

$$U(x) \simeq U(x_0) + \left[\frac{1}{2}\frac{\partial^2U}{\partial x^2}|_{x_0}\right](x-x_0)^2$$

$$\text{Force } F(x) = -\frac{\partial U}{\partial x}$$

$$\begin{aligned}
\frac{\partial U}{\partial x} &= \frac{\partial}{\partial x}\left\{ U(x_0) + \left[\frac{1}{2}\frac{\partial^2U}{\partial x^2}|_{x_0}\right](x-x_0)^2\right\} \\
&= \left\{ 0 + 2\left[\frac{1}{2}\frac{\partial^2U}{\partial x^2}|_{x_0}\right](x-x_0)\right\} \\
&= \left[\frac{\partial^2U}{\partial x^2}|_{x_0}\right](x-x_0)
\end{aligned}$$

$$(U(x) - U(x_0)) \simeq \left[\frac{1}{2}\frac{\partial^2U}{\partial x^2}|_{x_0}\right](x-x_0)^2$$

$$\left(\frac{U(x)-U(x_0)}{x-x_0}\right) \simeq \left[\frac{1}{2}\frac{\partial^2U}{\partial x^2}|_{x_0}\right](x-x_0)$$

$$F(x) \simeq -\left[\frac{\partial^2U}{\partial x^2}|_{x_0}\right](x-x_0)$$

$$F(x) \simeq -K(x - x_0)$$

$$F(x) = -Kx$$

$$m\,a(x) = -Kx$$

$$m\,a = -Kx$$

$$m\,\frac{d^2x}{dt^2} = -Kx$$

$$\frac{d^2x}{dt^2} = -\left(\frac{K}{m}\right)x$$

$$\omega \equiv \sqrt{\frac{K}{m}}$$

$$\frac{d^2x}{dt^2} = -\,\omega^2 x$$

$$x(t) = A\cos(\omega t + \phi)$$

$$x(t) = A\sin(\omega t) + B\cos(\omega t)$$

$$h(x) = H\left[1 - \cos(\frac{2\pi x}{L})\right]$$