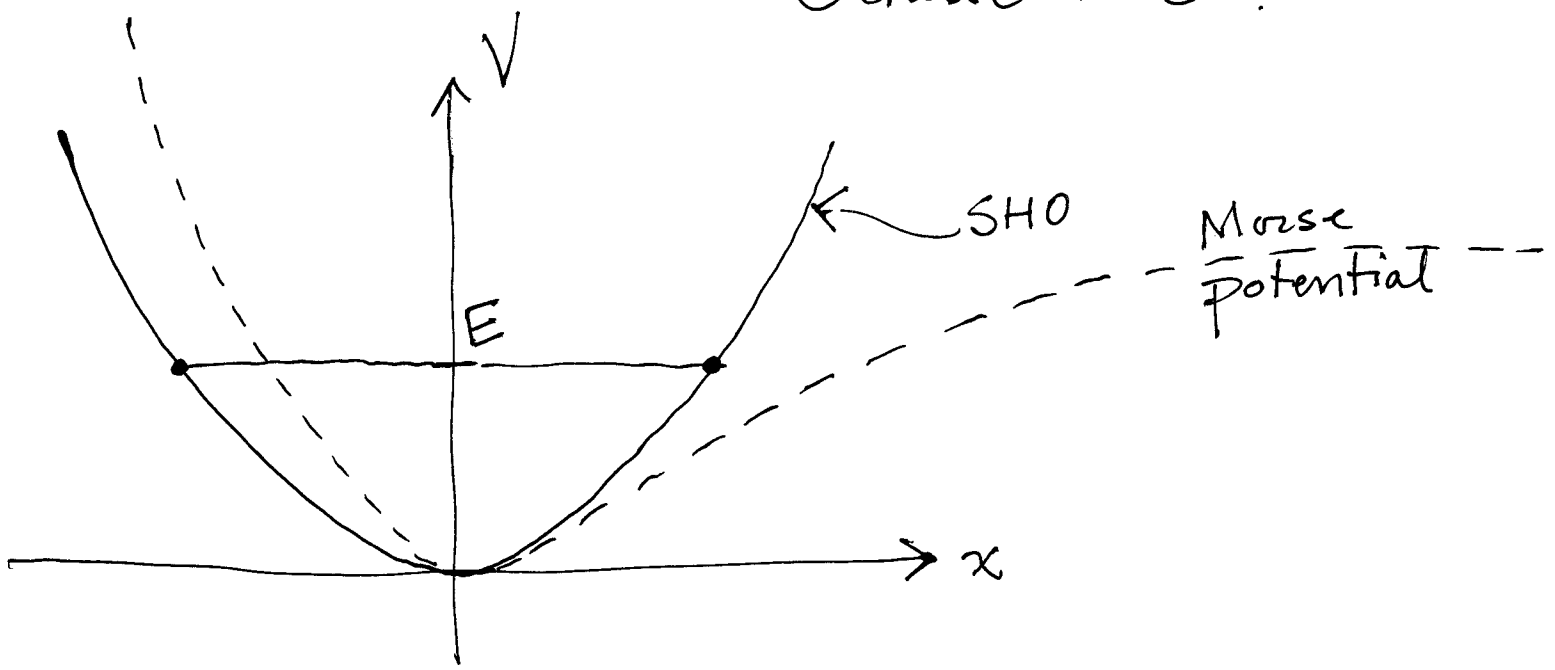
SHO: $F = -kx = -\frac{dV}{dx}$

x: displacement from equilibrium

$\rightarrow \quad V(x) = \frac{1}{2}kx^2 + C$

C: choose $= 0$.



We want to approximate $f(x)$ at $x = x_0$

Approximation of order 0: $f_0 = f(x_0)$

" " " 1: $f_1(x) = A + Bx$

$f_1(x_0) = f(x_0) \rightarrow A + Bx_0 = f(x_0)$

$f_1'(x_0) = f'(x_0) \rightarrow B = f'(x_0)$

$\rightarrow A = f(x_0) - x_0 f'(x_0)$

$$\boxed{f_1(x) = f(x_0) + f'(x_0)(x - x_0)}$$

Ex.: $f(x) = e^x$, $x_0 = 0$: $f_1(x) = 1 + x$

$\sin(x)$, $x_0 = 0$: $f_1(x) = x$

$\cos(x)$, $x_0 = 0$: $f_1(x) = 1$