

### [mex232] Potential energy of periodic motion reconstructed

Consider a particle of mass  $m$  undergoing oscillatory motion at energy  $E$  in a symmetric potential  $V(x)$  with  $V(0) = 0$ . Show that for given period  $T(E)$  of the motion the shape of the potential energy can be reconstructed from the expression

$$x(V) = \frac{1}{2\pi\sqrt{2m}} \int_0^V dE \frac{T(E)}{\sqrt{V-E}}.$$

Note the inverse relationship of this result to that of [mex5]. Apply the above expression to the case where  $T = 2\pi/\omega_0$  independent of  $E$ .

**Solution:**