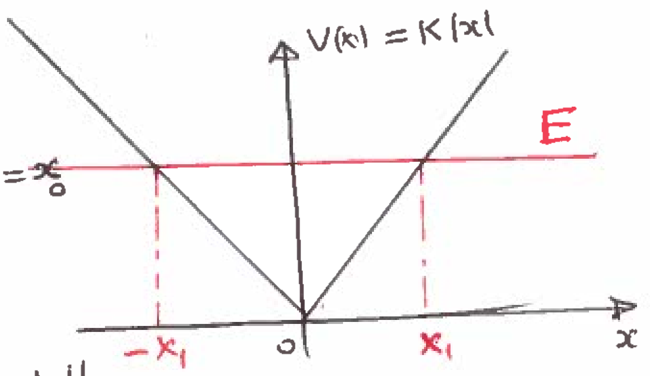
Q1.

Turning points are at , $E > 0$

$$E = V(x) = K|x|$$

$$\Rightarrow |x_1| = \frac{E}{K}, \quad x_1 = -\frac{E}{K} \; ; \; x_2 = \frac{E}{K} = x_0$$



$$\int_{-x_0}^{+x_0} dx \sqrt{2mE\left(1 - \left|\frac{x}{x_0}\right|\right)}\, dx \; ; \quad u = \frac{x}{x_0}$$

$$= 2\int_0^1 dx \sqrt{2mE}\sqrt{1-u}\; x_0\, du \; , \quad \text{let } v = 1-u$$

$$= 2\sqrt{2mE}\, x_0 \int_0^1 \sqrt{1-u}\, du = 2\sqrt{2mE}\, x_0 \int_0^1 \sqrt{v}\, dv = 2\sqrt{2mE}\, x_0 \frac{v^{3/2}}{3/2}\Big|_0^1$$

$$\frac{1}{\hbar}\,\frac{4}{3}\, x_0 \sqrt{2mE} = \left(n + \frac{1}{2}\right)\pi \; ; \quad x_0 = \frac{E}{K}$$

$$\frac{4}{3}\,\frac{\sqrt{2m}}{K}\, E^{3/2} = \left(n+\frac{1}{2}\right)\pi\hbar \Rightarrow \boxed{E_n = \left[\frac{3K\pi\hbar}{4\sqrt{2m}}\left(n+\frac{1}{2}\right)\right]^{2/3} \; ; \; n = 0, 1, 2 \cdots}$$

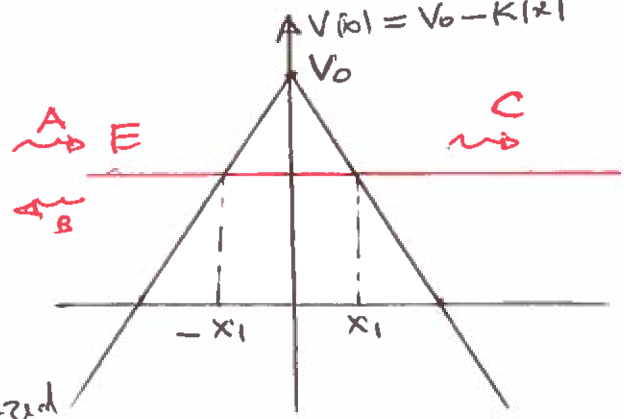
Q2.

$E < V_0$ Turning points at

$$E = V(x) = V_0 - K|x|$$

$$\Rightarrow |x| = \frac{V_0 - E}{K} \Rightarrow x = \pm x_0$$

$$x_0 = \frac{V_0 - E}{K}$$



This is a barrier $\Rightarrow$ Tunneling, characterized by transmission coefficient

$$T = \left|\frac{C}{A}\right|^2 \doteq e^{-2\gamma} = \exp\left(-\frac{8}{3}\,\frac{\sqrt{2m}}{\hbar K}(V_0 - E)^{3/2}\right)$$

$$\gamma = \frac{1}{\hbar}\int_{-x_0}^{+x_0} \sqrt{2m(V_0 - K|x| - E)}\, dx = \frac{1}{\hbar}\sqrt{2m(V_0 - E)} \int_{-x_0}^{x_0} \sqrt{1 - \frac{|x|}{x_0}}\, dx$$

$$\gamma = \frac{2}{\hbar}\sqrt{2m(V_0-E)} \int_0^1 \sqrt{1-u}\; x_0\, du = \frac{2x_0}{\hbar}\sqrt{2m(V_0-E)}\left(\frac{2}{3}\right)$$

$$\gamma = \frac{4}{3}\,\frac{\sqrt{2m}}{\hbar K}(V_0 - E)^{3/2}$$