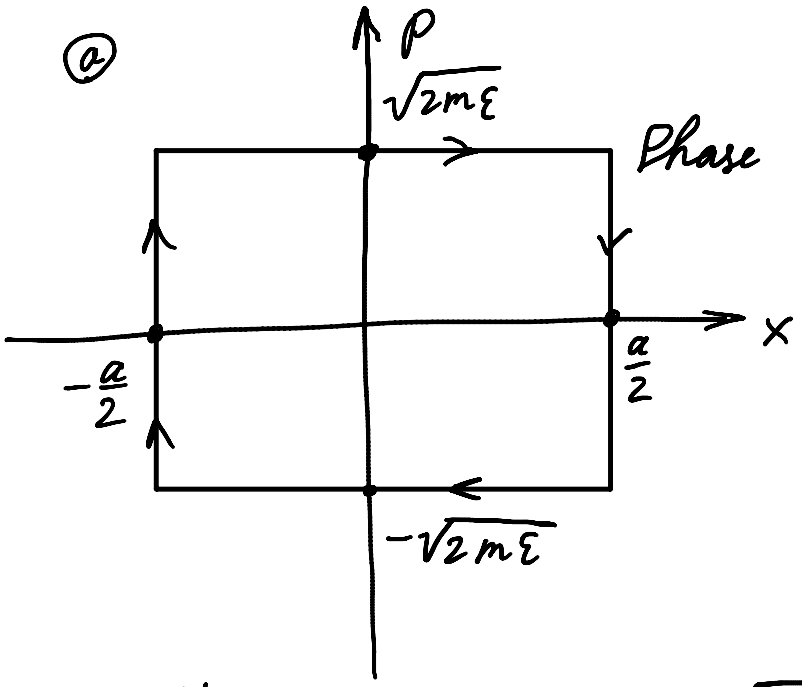
(1) The particle gets reflected from both walls, at $x = \frac{a}{2}$ and $x = -\frac{a}{2}$

(a)



(b) The area $S = 2a\sqrt{2m\mathcal{E}} = 2ak$

(c) Momentum quantisation in a rectangular box: $k_n = \frac{\pi\hbar}{a} n$

$$\oint p\,dx = S = 2ak_n = 2\pi\hbar n$$

$$\boxed{\oint p\,dx = 2\pi\hbar n}$$ - Bohr-Sommerfeld quantisation rule

(2) $$dn = 2\pi n \cdot \left(\frac{m}{2\pi T}\right) e^{-\frac{mv^2}{2T}} dv = \frac{nm}{T} e^{-\frac{mv^2}{2T}} dv$$

$$dn(\vec{v}) = \frac{mn}{2\pi T} e^{-\frac{mv^2}{2T}} d\vec{v}$$

$$dn(\vec{v}) = \frac{mn}{2\pi T} e^{-\frac{mv^2}{2T}} d\vec{v}$$

(Repeating the derivation from the lecture for 2D)

③ $\varepsilon_m = \frac{T}{2}$

④ $T = \frac{mv^2}{3}$

⑤ $\left\langle \frac{1}{p} \right\rangle = \sqrt{\frac{2}{\pi m T}}$