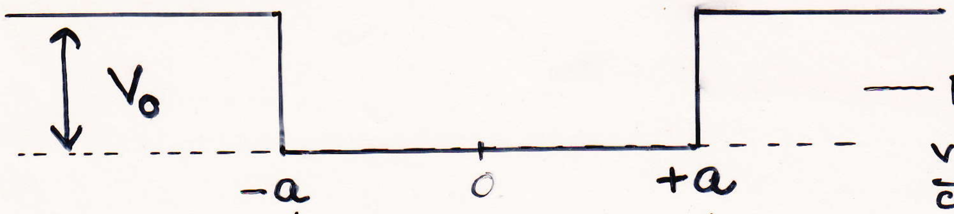
Př.: Pravoúhlá potenciálová jáma jednorozměrná



$E < V_0$ vázané stavy částice v jámě

$$-\frac{\hbar^2}{2m}\frac{d^2\psi}{dx^2} = \underbrace{(E-V_0)}_{<0}\psi \qquad -\frac{\hbar^2}{2m}\frac{d^2\psi}{dx^2} = \underbrace{E}_{>0}\psi \qquad -\frac{\hbar^2}{2m}\frac{d^2\psi}{dx^2} = \underbrace{(E-V_0)}_{<0}\psi$$

$$\varkappa = \sqrt{\frac{2m(V_0-E)}{\hbar^2}} \qquad k = \sqrt{\frac{2mE}{\hbar^2}}$$

Řešení ve tvaru

$$\cancel{C' e^{-\varkappa x}} + D e^{\varkappa x} \qquad A\cos kx + B\sin kx \qquad C e^{-\varkappa x} + \cancel{D' e^{\varkappa x}}$$

Spojitost ψ na rozhraní

$$D e^{-\varkappa a} = A\cos ka - B\sin ka$$
$$A\cos ka + B\sin ka = C e^{-\varkappa a}$$

Spojitost $\frac{d\psi}{dx}$ na rozhraní

$$D\varkappa e^{-\varkappa a} = Ak\sin ka + Bk\cos ka$$
$$-Ak\sin ka + Bk\cos ka = -C\varkappa e^{-\varkappa a}$$

$$2A\cos ka = (C+D)e^{-\varkappa a} \qquad 2B\sin ka = (C-D)e^{-\varkappa a}$$

$$2Ak\sin ka = \varkappa(C+D)e^{-\varkappa a} \qquad 2Bk\cos ka = (D-C)\varkappa e^{-\varkappa a}$$

$$\boxed{A \neq 0 : \quad (ka)\,\mathrm{tg}(ka) = \varkappa a} \qquad \boxed{B \neq 0 : \quad (ka)\,\mathrm{cotg}(ka) = -\varkappa a}$$

$$(ka)^2 + (\varkappa a)^2 = \underbrace{\frac{2mV_0 a^2}{\hbar^2}}_{R^2}$$

1) $(ka)\,\mathrm{tg}(ka) = \varkappa a$

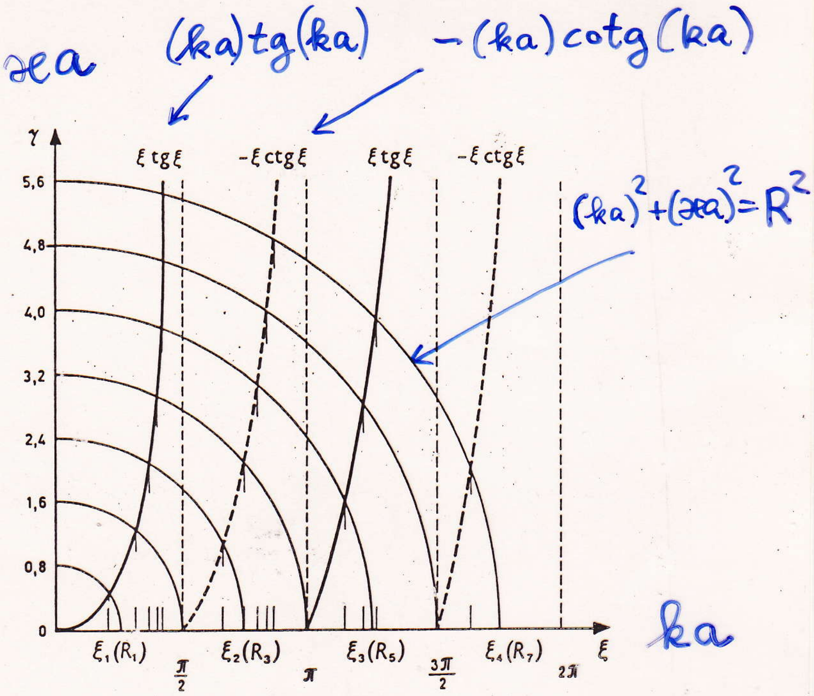
řešení $A \neq 0$, $B = 0$

funkce sudá

2) $-(ka)\,\mathrm{cotg}(ka) = \varkappa a$

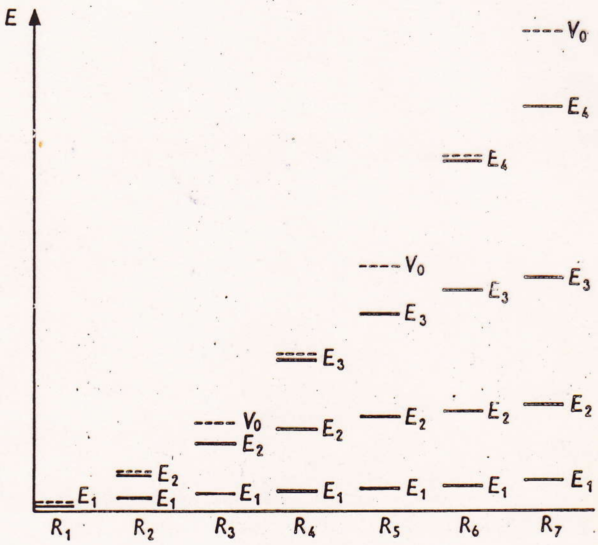
řešení $A = 0$, $B \neq 0$

funkce lichá



Obr. 2.2

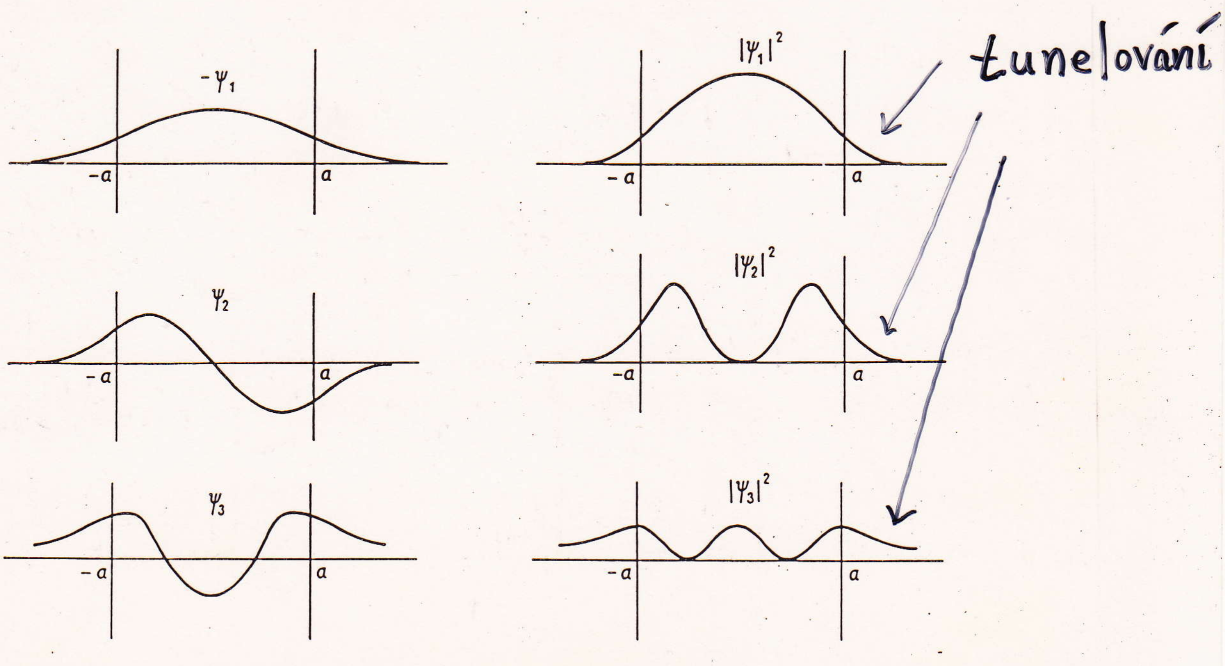
Pro každou jámu existuje aspoň 1 vázaný stav



1)

2)

1)



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