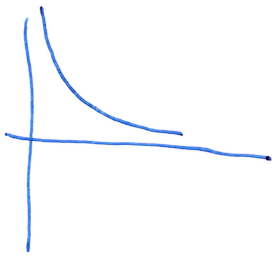
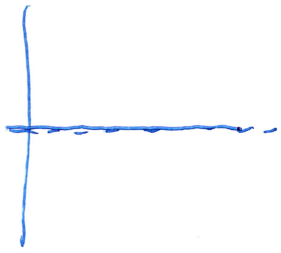
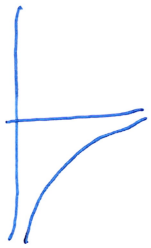
2.

$$V_{eff} = \frac{k}{r^2} + \frac{p_\varphi^2}{2mr^2} = \frac{\tilde{k}}{r^2}$$

$\tilde{k} > 0$  $\tilde{k} = 0$  $\tilde{k} < 0$ 

Za $\tilde{k} \geq 0$ so vse orbite nevezane.

Za $\tilde{k} < 0$ so nevezane orbite z $E > 0$

1/4

$$E = \frac{p_\varphi^2}{2mr^2} + \frac{k}{r^2} + \frac{1}{2}mr'^2 = \frac{\tilde{k}}{r^2} + \frac{1}{2}mr'^2$$

$u = 1/r$

$u' = -\frac{1}{r^2}r'$

$p_\varphi = mr^2\dot{\varphi}$

$$\dot{r} = \frac{dr}{dt} = \frac{dr}{d\varphi}\dot{\varphi} = \frac{dr}{d\varphi}\frac{p_\varphi}{mr^2}$$

$$\dot{\varphi} = \frac{p_\varphi}{mr^2}$$

Najbo $\tilde{k} > 0$!

1/4

$$E = \frac{\tilde{k}}{r^2} + \frac{p_\varphi^2 r'^2}{2mr^4} = \frac{\tilde{k}}{r^2}u^2 + \frac{p_\varphi^2}{2m}u'^2$$

$$\frac{E2m}{p_\varphi^2} = \frac{\tilde{k}2m}{p_\varphi^2}u^2 + u'^2$$

$\frac{E2m}{p_\varphi^2} = e^2$, $\frac{\tilde{k}2m}{p_\varphi^2} = A^2$

$e^2 = A^2u^2 + u'^2$ Rešitev $u = e\cos(\varphi A + \varphi_0)$

$$r = \frac{1}{e\cos(\varphi A + \varphi_0)}$$

1/4

1

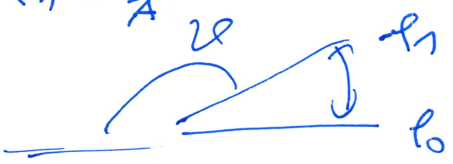
Sipalni kot:

izberimo $\varphi_0 = -\pi/2$

$$r = \frac{1}{e\cos\left(\varphi A - \frac{\pi}{2}\right)} = \frac{1}{e\sin(\varphi A)}$$

delec pride iz $r = \infty$ pri $\varphi = 0$ in gre proti $r = b$

ko $\varphi A = \pi \Rightarrow \varphi_1 = \frac{\pi}{A}$



Sipalni kot je

$$\pi - \varphi_1$$

$$\chi = \pi\left(1 - \frac{1}{A}\right) = \pi\left(1 - \frac{1}{\sqrt{1 + \frac{k^2 m}{p_\varphi^2}}}\right)$$

$$= \pi\left(1 - \frac{1}{\sqrt{1 + \frac{t^2}{m v_0^2 b^2}}}\right)$$

$p_\varphi = m v_0 b$

$\frac{1}{4}$