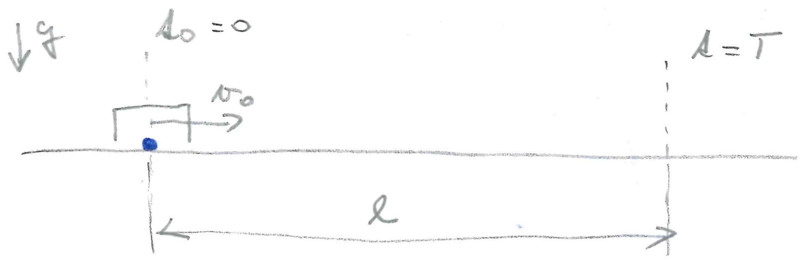
CV2 - PŘ1 - ~~[illegible]~~

HMOTNÝ BOD SE POHYBUJE PO VODOROVNÉ DRSNÉ ROVINĚ
URČETE ČAS POTŘEBNÝ K ZASTAVENÍ A BRZDNOU DRÁHU

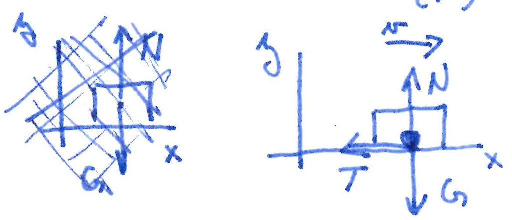
D: $m, g, f, v_0$

U: a) $l$ ; b) $t = T$



ad a) KE STANOVENÍ $l$ VYUŽIJEME VZKE

$$K_2 - K_1 = \int_{(m)} \vec{F} \cdot d\vec{r}$$ - KŘIVKOVÝ INTEGRÁL II. DRUHU



$$\vec{F} = \begin{bmatrix} -T \\ 0 \end{bmatrix} \qquad d\vec{r} = \begin{bmatrix} dx \\ 0 \end{bmatrix}$$

$$T = f m g$$

$$K_2 - K_1 = -\int_0^l f m g \, dx$$

$$-\frac{1}{2} m v_0^2 = -\left[ f m g x \right]_0^l = -(f m g l - 0)$$

$$v_0^2 = 2 f g l$$

$$\boxed{l = \frac{v_0^2}{2 f g}}$$

b) KE STANOVENÍ DOBY BRZDĚNÍ VZH

$$\vec{p}_2 - \vec{p}_1 = \int_{t_1}^{t_2} \vec{F} \, dt$$

POHYB PODÉL $x$: $m v_2 - m_1 v_1 = \int_{t_1}^{t_2} F_x \, dt$

$y$: $0 = 0$

$$\underbrace{m v(t_2)}_{0} - m \underbrace{v(t_1)}_{v_0} = \int_0^T F_x \, dt$$

$$- m v_0 = - \int_0^T m g f \, dt$$

$$m v_0 = m g f \, [t]_0^T$$

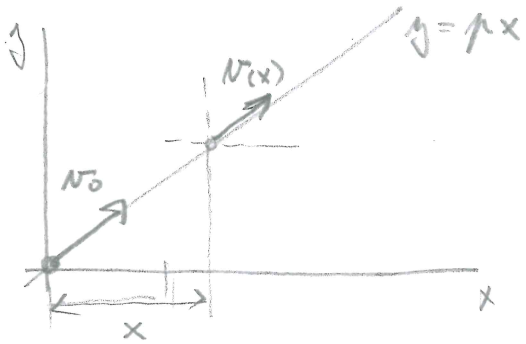
$$T = \frac{v_0}{f g}$$

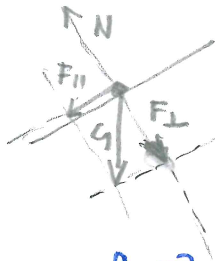
CV2 - PŘ 2

HMOTNÝ BOD SE POHYBUJE PO PŘÍMCE $k: y = px$ V TÍHOVÉM POLI. URČETE RYCHLOST $v$ V ZÁVISLOSTI NA SOUŘADNICI $x$. POČÁTEČNÍ RYCHLOST JE NENULOVÁ.

D: $v_0$; $g$; $k$; neuvažujeme tření

U: $v(x)$




$$K_2 - K_1 = \int_{(r)} \vec{G}\cdot d\vec{r} \equiv \oint_{\vec{r}_1}^{\vec{r}_2} \vec{G}\cdot d\vec{r}$$

$$K_2 - K_1 = \int_{(r)} (0; -mg)\cdot(dx; dy)$$

$$y = px \qquad (y = y(x))$$

$$dy = p\,dx \qquad \boxed{\begin{matrix} x_0 = 0 \\ X = x \end{matrix}}$$

$$K_2 - K_1 = \int_{(r)} (0; -mg)\cdot(dx; p\,dx) \quad x_r \in \langle 0; x \rangle$$

$$\frac{1}{2} m (v_2^2 - v_1^2) = \int_0^{X} -mgp\,dx$$

$$v_2^2 - v_0^2 = -2gp\,[x]_0^{X}$$

$$\cancel{v_2} =$$

$$v^2_{(X)} - v_0^2 = -2gpX$$

$$v_{(X)} = \pm\sqrt{v_0^2 - 2gpX}$$

CV 2 - PŘ. 3

HMOTNÝ BOD SE POHYBUJE PO DRSNÉ NAKLONĚNÉ ROVINĚ SMĚREM NAHORU. PŘI ZNALOSTI POČÁTEČNÍ RYCHLOSTI A SE ZAPOČTENÍM ODPORU VZDUCHU $\sigma = c \cdot v$ VYPOČTĚTE

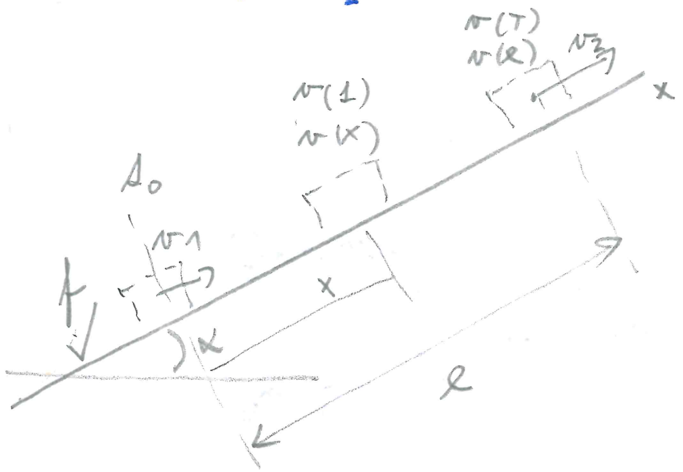
a) ZÁVISLOST RYCHLOSTI NA DRÁZE $l$

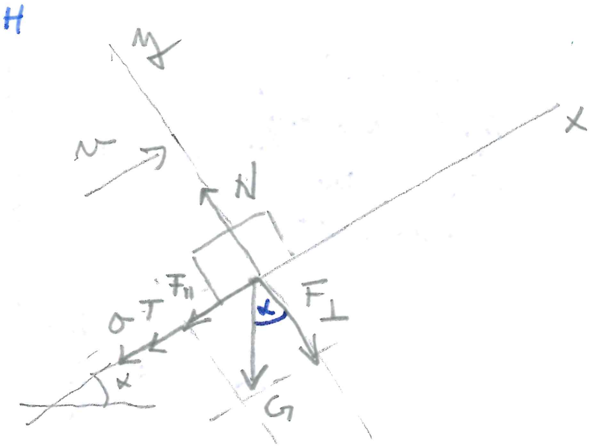
b) ——— " ——— NA ČASE $t$

D: $m, g; f; \alpha; v_1$ - počáteční; $\sigma = c \cdot v$

U: a) $v_2(l) = v(x)$ → VZKE

b) $v_2(t)$ → VZH




$$F_{\parallel} = -m \cdot g \cdot \sin\alpha$$

$$F_{\perp} = -m \cdot g \cdot \cos\alpha$$

$$T = N \cdot f = m \cdot g \cdot \cos\alpha \cdot f$$

$$F_x = -T - mg\sin\alpha - cv$$

$$F_y = N - mg\cos\alpha = 0$$

$$F_x = -Nf - m \cdot g \cdot \sin\alpha - cv = -m \cdot g\,(\sin\alpha + f\cos\alpha) - cv$$

$$F_x = -cv - m\underbrace{g\,(f\cos\alpha + \sin\alpha)}_{\tilde{g}}$$

$$F_x = -cv - m\tilde{g}$$

a) VZKE: $K_2 - K_1 = \int_{\vec{r}_1}^{\vec{r}_2} \vec{F} \cdot d\vec{r}$

$$\frac{1}{2} m (v_2^2 - v_1^2) = \int_0^l F_x\,dx = \int_0^l (-cv - m\tilde{g})\,dx$$

! $v(x)$

DIF. TVAR: $dK = \vec{F} \cdot d\vec{r}$

$K = \frac{1}{2} m v^2$

$dK = m v\,dv$

$$m \frac{d\vec{v}}{dt} \cdot d\vec{r} = \vec{F} \cdot d\vec{r}$$

$$m\vec{v}\,d\vec{v} = m\frac{d(v^2)}{2} = \vec{F}\cdot d\vec{r}$$

$$m v\,dv = (-cv - m\tilde{g})\,dx$$

$$\int_{v_1}^{v_2} \frac{m v\,dv}{-cv - m\tilde{g}} = \int_0^{l} dx$$

SUB.: $-cv - m\tilde{g} = u$

$-c\,dv = du$

$dv = -\frac{1}{c}\,du$

$v_1 \rightsquigarrow -cv_1 - m\tilde{g}$

$v_2 \rightsquigarrow -cv_2 - m\tilde{g}$

$$\frac{m}{c^2}\int_{-cv_1-m\tilde{g}}^{-cv_2-m\tilde{g}} \frac{u + m\tilde{g}}{u}\,du = \int_0^{l} dx$$

$$l = \frac{m}{c^2}\Big[u + m\tilde{g}\ln|u|\Big]_{-cv_1-m\tilde{g}}^{-cv_2-m\tilde{g}}$$

$$l = \frac{m}{c^2}\left[cv_1 - cv_2 + m\tilde{g}\ln\left(\frac{cv_2 + m\tilde{g}}{cv_1 + m\tilde{g}}\right)\right]$$

$$l = f(v_2)$$

$v_2 \overset{\sim}{=} f(l)$ – NUMERICKY

b) $v_2(t) = ?$ → VZH

$$d\vec{p} = \vec{F}\,dt$$

$$m\,d\vec{v} = \vec{F}\,dt$$

$$m\,dv = (-cv - m\tilde{g})\,dt$$

$$\int_{v_1}^{v_2} \frac{m}{-cv - m\tilde{g}}\,dv = \int_{0}^{t} dt$$

$$T = \int_{v_1}^{v_2} \frac{m}{-cv - m\tilde{g}}\,dv \overset{\text{SUB.}}{=} -\frac{1}{c}\int_{-cv_1-m\tilde{g}}^{-cv_2-m\tilde{g}} \frac{m}{u}\,du = -\frac{1}{c}\ln\frac{cv_2+m\tilde{g}}{cv_1+m\tilde{g}}$$

$$v_2 = \left[e^{-Tc}\cdot(cv_1 + m\tilde{g}) - m\tilde{g}\right]\frac{1}{c}$$