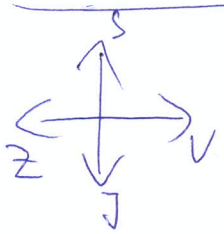
1. 3 km ..... na S
2 km ..... na SV (45° od Severu v smere hod. ruč.)
4 km ..... na Z
3 km ..... na JV



a) $\vec{r_1} = 0\vec{i} + 3\vec{j}$

$\vec{r_2} = \sqrt{2}\vec{i} + \sqrt{2}\vec{j}$

$\vec{r_3} = -4\vec{i} + 0\vec{j}$

$\vec{r_4} = \frac{3}{\sqrt{2}}\vec{i} - \frac{3}{\sqrt{2}}\vec{j}$

1,5 b

b) $3 + 2 + 4 + 3 =$ **12 km** 0,5 b

c) $|\vec{r}| = ?$

$\vec{r} = \vec{r_1} + \vec{r_2} + \vec{r_3} + \vec{r_4}$

$\vec{r} = \left(\sqrt{2} - 4 + \frac{3}{\sqrt{2}}\right)\vec{i} + \left(3 + \sqrt{2} - \frac{3}{\sqrt{2}}\right)\vec{j}$

$\vec{r} = -0{,}464\,\vec{i} + 2{,}293\,\vec{j}$

$|\vec{r}| \doteq 2{,}34$ km 1 b

(2) $v_2 = 70\ km/h = 19{,}4\ m/s$

$v_1 = 60\ km/h = 16{,}6\ m/s$

$d = 20\ m$

$l = 4\ m$

$s_2 = d + l + d + v_1 t + l = 2d + 2l + v_1 t$ 1b

$v_2 t = 2d + 2l + v_1 t$

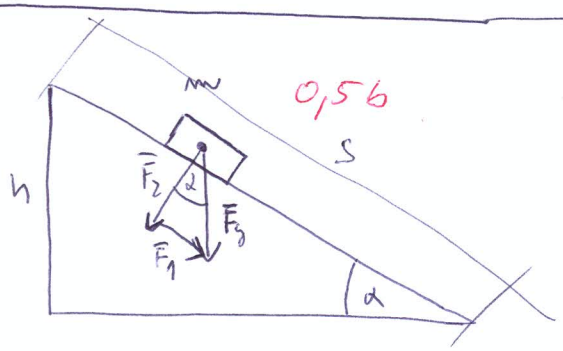
$v_2 t - v_1 t = 2d + 2l$

$t = \frac{2d+2l}{v_2 - v_1}$ 0,5b

$s_2 = v_2 t = v_2 \frac{2d+l}{v_2 - v_1} = 19{,}4 \frac{2 \cdot 20 + 2 \cdot 4}{19{,}4 - 16{,}6} = 332{,}57\ m$ 0,5b

---

(3)



0,5b

$F_1 = ma = mg\sin\alpha$

$a = g\sin\alpha$ 0,5b

$s = \frac{1}{2} a t^2$

$\sqrt{\frac{2s}{a}} = t$

$v_2 = at$

$v_2 = g\sin\alpha \sqrt{\frac{2s}{g\sin\alpha}}$

$v_2 = \sqrt{\frac{2s\, g^2 \sin^2\alpha}{g\sin\alpha}}$

$v_2 = \sqrt{2s\, g \sin\alpha}$ 1b

$E_k = \frac{1}{2} m v^2 = \frac{1}{2} m \cancel{2} g \cancel{s} \sin\alpha = mgh$ (h = $s \cdot \sin\alpha$)

1b

$E_k = mgh = E_p$

④ $R = 4{,}22 \cdot 10^8\ m$

$T = 42{,}5\ h$

$\mathcal{K} = 6{,}67 \cdot 10^{-11}\ N m^2 kg^{-2}$

$|\bar{F}_{od}| = |\bar{F}_g|$

$\frac{m v^2}{R} = \mathcal{K} \frac{M \cdot m}{R^2}$ 1b

$\frac{\omega^2 R^2}{R} = \mathcal{K} \frac{M}{R^2}$

$\frac{\omega^2 R^3}{\mathcal{K}} = M$

$M = \frac{4\pi^2 R^3}{\mathcal{K} T^2} \doteq 1{,}9 \cdot 10^{27}\ kg$ 0,5b 0,5b

$v = \omega \cdot r$

$a_{od} = \omega^2 r$

$a_{od} = \frac{v^2}{r}$
