# Modul 11 - Zadaci

Sunday, January 7, 2024 4:53 PM

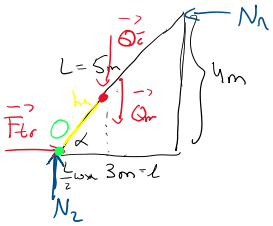
11.10) $L = 5m$

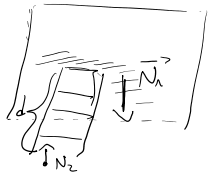
$l = 3m$

$Q_m = 160N$

$\mu_s = 0{,}40$

$Q_č = 740N$




$\sin\alpha = \frac{\text{nas.}}{\text{hip.}}$

$\sin\alpha = \frac{l'}{L}$ $\quad l' = 3'$

a) $F_{tr_{max}} = ?$

$F_{trmax} = N_2 \mu_s$

$N_2 = Q_m + Q_č$

$F_{trmax} = \mu_s (Q_m + Q_č)$

$\boxed{F_{trmax} = 360N}$

b) $F_{tr_1} = ?$

$h^2 = 5^2 - 3^2 = 25 - 9 \Rightarrow \boxed{h = 4m}$

$h_1 = 1m$

1) $F_{tr} = N_1$

2) $N_2 = Q_m + Q_č$

3) $N_1 L \sin\alpha = Q_č \cos\alpha + Q_m \frac{L}{2} \cos\alpha$

$F_{tr} L \sin\alpha = \cos\alpha \left(Q_č + \frac{1}{2} L Q_m\right)$

$F_{tr} = \frac{\cos\alpha \left(Q_č + \frac{1}{2} L Q_m\right)}{L \sin\alpha}$ $\quad \boxed{F_{tr} = 171N}$

*jednačine ravnoteže

1) $\sum X_i = F_{tr} - N_1 = 0$

2) $\sum Y_i = N_2 - Q_m - Q_č = 0$

3) $F_{tr} \leq \mu_s N_2$

4) $\sum M_O^{(+)} = -Q_č h_1 \cos\alpha - Q_m \frac{L}{2} \cos\alpha + N_1 L \sin\alpha = 0$

c) $\sin\alpha = \frac{d}{L}$ $\quad d$ - distanca po dijagonali

$\frac{d}{L \sin\alpha} = 1$

$\sin\alpha = \frac{4}{5}$ $\quad \cos\alpha = \frac{3}{5}$

$\operatorname{ctg}\alpha = \frac{\cos\alpha}{\sin\alpha} = \frac{\frac{3}{5}}{\frac{4}{5}} = \frac{3}{4}$

3) $F_{tr} L \sin\alpha = Q_č h_2 \cos\alpha + Q_m \frac{L}{2} \cos\alpha$

$F_{tr} = Q_č \frac{h_2}{L} \operatorname{ctg}\alpha + Q_m \frac{1}{2} \operatorname{ctg}\alpha$

$F_{tr} = 360$

$F_{tr} - Q_m \frac{\operatorname{ctg}\alpha}{2} = \frac{Q_č \operatorname{ctg}\alpha}{L} h_2$

$h_2 = \frac{F_{tr} - Q_m \frac{\operatorname{ctg}\alpha}{2}}{\frac{Q_č \operatorname{ctg}\alpha}{L}}$ $\quad \boxed{h_2 = 2{,}702m}$

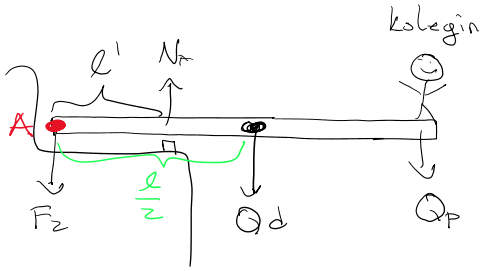
11.11) $l = 3m$

$l' = 1m$

$Q_P = 500N$

$Q_d = 280N$

a) $N_A = ?$




*jednačine ravnoteže

a) $N_A = ?$

$N_A \ell' = Q_d \frac{\ell}{2} + Q_p \ell$

$\boxed{N_A = 1920N}$

b) $F_2 = ?$

$F_2 = N_A - Q_d - Q_p$

$\boxed{F_2 = 1140N}$

* jednačine ravnoteže

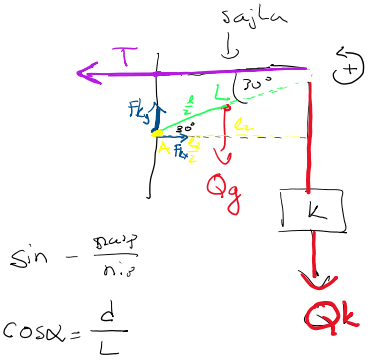
$\sum M_A = N_A \ell' - Q_d \cdot \frac{\ell}{2} - Q_p \cdot \ell = 0$

$\sum Y_i = N_A - F_2 - Q_d - Q_p = 0$

11.13) $T = ?$

$F_2 = ?$

$Q_k = Q_g = G$




$\sin = \frac{\text{nasuprotna}}{\text{hipotenuza}}$

$\cos\alpha = \frac{d}{L}$

* jednačine ravnoteže

1) $\sum X_i = T - F_{kx} = 0$

2) $\sum Y_i = F_{ky} - Q_g - Q_k = 0$

3) $\sum M_A^{(+)} = TL\sin 30° - G\cos 30° \frac{L}{2} - G\cos 30° L = 0$

$T = ?, \; F_{ky} = ?, \; F_{kx} = ?$

2) $F_{ky} = Q_g + Q_k = 2G$

3) $TL\sin 30° - G\cos 30° \frac{L}{2} - G\cos 30° L = 0 \;/\cdot L$

$T\sin 30° = G\cos 30° \frac{1}{2} + G\cos 30°$

$T = G\,ctg\,30° \frac{1}{2} + G\,ctg\,30° = \frac{3}{2} G\,ctg\,30°$

1) $T - F_{kx} = 0$

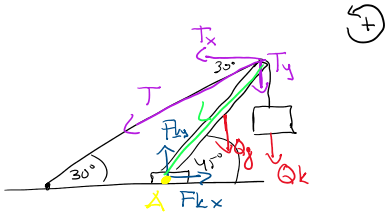
$F_{kx} = T \Rightarrow \boxed{F_{kx} = \frac{3}{2} G\,ctg\,30°}$

$\Rightarrow \boxed{F_k = \sqrt{T^2 + (2G)^2}}$

$\boxed{T = \frac{3}{2} G\,ctg\,30°}$

b) $T_x = \cos 30° T$

$T_y = \sin 30° T$




* jednačine ravnoteže

$\sum X_i = T_x - F_{kx} = 0$

$\sum Y_i = F_{ky} - T_y - Q_k - Q_g = 0$

$F_{kx} = \frac{3G\cos 30°}{2(\cos 30° - \sin 30°)}$

$F_{ky} = 2G + \frac{3G\sin 30°}{2(\cos 30° - \sin 30°)}$

$\boxed{F = \sqrt{F_{kx}^2 + F_{ky}^2}}$

$\sum M_A^{(+)} = T\cos 30°(\sin 45° L) - T\sin 30°(\cos 45° L) - G(\cos 45° L) - G(\cos 45° \frac{L}{2}) = 0$

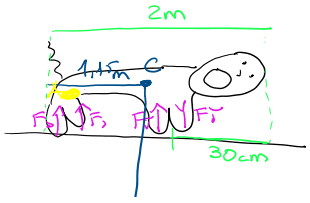
$T\cos 45° L(\cos 30° - \sin 30°) = \frac{3}{2} G\cos 45° L$

$T = \frac{3G}{2(\cos 30° - \sin 30°)}$

11.15) $m_s = 820kg$

$h = 2m$

$\ell_c = 1.15m \rightarrow$




* jednačine ravnoteže

$\sum X_i = 0$

$\sum Y_i = +2F_2 + 2F_1 - Q = 0$

$\sum M^{(+)} = -Q\,1.15 + 2F_2 \cdot 1.7 = 0$

$h = 2m$

$l_c = 1,15m \rightarrow$

$l_r = 0,3m \leftarrow$

$F_j = ?\ ,\ F_s = ?$

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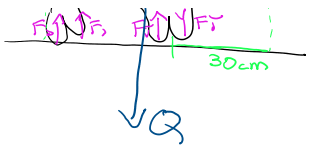
$Q_s = m_s \cdot g$




$\sum Y_i = +2F_s + 2F_j - Q = 0$

$\sum M_A^D = -Q\,1,15 + 2F_s \cdot 1,7 = 0$

$Q = 2F_j + 2F_s$

$2F_j \cdot 1,7 = 1,15Q$

$F_j = \frac{1,15Q}{2 \cdot 1,7}$ $\boxed{F_j = 272N}$

$F_s = \frac{Q - 2F_j}{2}$ $\boxed{F_s = 130N}$

11.16) $F = 650N$

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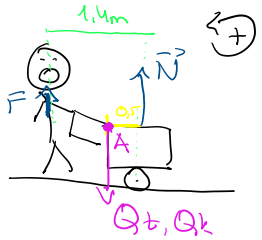
a) $l_1 = 1,4m$

$Q_k = 80,0N$

$l_2 = 0,5m = l_t$




*jednadžine ravnoteže

$\sum X_i = 0$

$\sum Y_i = F + N - Q_t - Q_k = 0$

$\sum M_A^D = N \cdot 0,5 - F \cdot 0,9 = 0$

b) Sila N koja nam pomaže tako što smanjuje težinu $Q_t$

$N \cdot 0,5 = 0,9F$

$N = \frac{0,9F}{0,5}$ $\boxed{N = 1170N}$

$Q_t = F + N - Q_k$ $\boxed{Q_t = 1740N}$

11.25) $l = 2m$

$\Delta l = 0,25cm = 0,25 \cdot 10^{-2}m$

$F = 400N$

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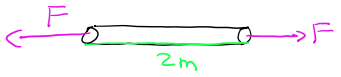
$R = ?$ $A = r^2\pi$

$R = 2r$ ↑ površina poprečnog presjeka




$\gamma = \frac{lF}{A\Delta l}$ $\gamma = 2 \cdot 10^{11}Pa$

$A = \frac{lF}{\gamma \Delta l}$ $\boxed{A = 1,6 \cdot 10^{-6}m^2}$

$r = \sqrt{\frac{A}{\pi}}$ $\boxed{r = 7,13 \cdot 10^{-4}m}$

$R = 2r$ $\boxed{R = 14,26 \cdot 10^{-4}m}$

11.28) $\Delta l = 1,1m$

$m_p = 65kg$

$Q = m_p \cdot g$

$l = 45m$

$r = 7 \cdot 10^{-3}m$

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$\gamma = ?$

$A = r^2\pi$

$\gamma = \frac{lQ}{A\Delta l}$ $\gamma = \frac{lm_pg}{r^2\pi\Delta l}$

$\boxed{\gamma = 1,69 \cdot 10^8Pa}$

$\gamma = ?$

11.46) $l = 12{,}0\,m$

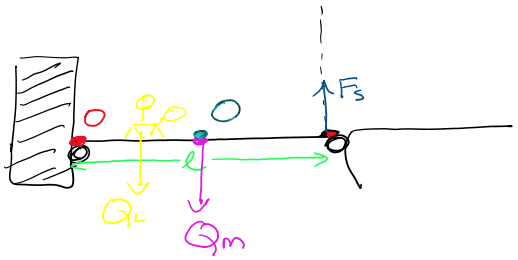
$F_{s_{max}} = 5{,}80 \cdot 10^3\,N$

$m = 200\,kg$

$M = 600\,kg$

$\boxed{Q_m = mg}$ $\boxed{Q_L = Mg}$

$l' = ?$ da li će preći?




* jednačine ravnoteže

$\Sigma X = 0$

$\Sigma Y = F_s - Q_L - Q_m$ ?

$\Sigma M_O^{\circlearrowleft} = F_s l - Q_m \frac{l}{2} - Q_L l = 0$

$F_s l = Q_m \frac{l}{2} + Q_L \frac{l}{2}$

$F_s = \frac{1}{2} Q_m + Q_L l \Rightarrow \boxed{F_s = 6867\,N}$ $F_s > F_{s_{max}}$

$\Rightarrow$ neće preći most!

$F_{s_{max}} l - Q_m \frac{l}{2} - Q_L l' = 0$

$Q_L l' = F_{s_{max}} l - Q_m \frac{l}{2}$

$l' = \frac{F_{s_{max}} l - Q_m \frac{l}{2}}{Q_L}$ $\boxed{l' = 9{,}824\,m}$

11.51) $L = 1{,}5\,m$

$M = 18{,}0\,kg$

$l = 1{,}2\,m$

$m_r = 28{,}0\,kg$

$d = 32\,cm = 0{,}32\,m$

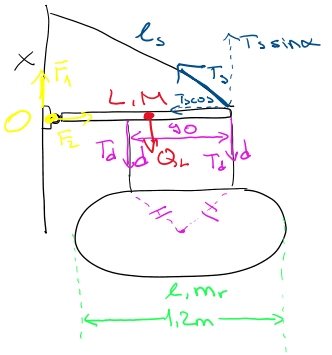
$sd = 90\,cm = 0{,}9\,m$

$l_s = 2{,}0\,m$

$\cos\alpha = \frac{\text{naleglu}}{\text{hipot.}}$

$\boxed{\cos\alpha = \frac{L}{l_s}}$

$\alpha = \arccos\left(\frac{L}{l_s}\right)$




$T_{du} = 2T_d$

$Q_L = Mg$

? zašto u $\Sigma M_O^{\circlearrowleft}$ ne uračunavamo i cos vrednost pošto smo razložili delovanje $F_s$-a i na x i na y osu?

a) $T_k = ?$

$T_{du} = 2T_d \Rightarrow T_d = \frac{T_{du}}{2}$

$T_{du} = m_r g$

$\Rightarrow T_d = \frac{m_r g}{2}$ $\boxed{T_d = 137{,}34\,N}$

$Q_L = Mg$ $\boxed{Q_L = 176{,}58\,N}$

* jednačine ravnoteže

$\Sigma X = /$

$\Sigma Y = F_1 + T_s \sin\alpha - Q_L - 2T_d = 0$

$\Sigma M_O^{\circlearrowleft} = T_s \cos\alpha\, L - T_d L - T_d\, 0{,}6 - Q_L \frac{L}{2}$

$T_s \sin\alpha\, L = T_d L + T_d\, 0{,}6 + Q_L \frac{L}{2}$

$T_s = \frac{T_d L + T_d\, 0{,}6 + Q_L \frac{L}{2}}{\sin\alpha\, L}$ $\boxed{T_s = 424{,}17\,N}$

$\boxed{T_s = T_k}$

$T_s = T_k$

b) $F_1 = ?$

$F_1 = 2T_d + Q_L - T_s \sin\alpha$

$\boxed{F_1 = 199{,}94\,N}$

11.69) $Q = 1250\,N$

$\alpha = 53{,}0°$

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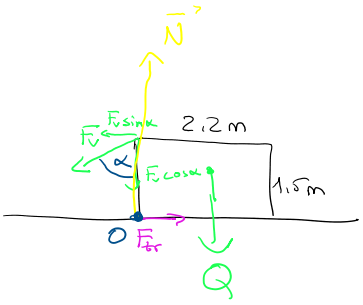
$F_v = ?$




* jednačine ravnoteže

$\Sigma X = F_{tr} - F_v \sin\alpha = 0$

$\Sigma Y = N - Q - F_v \cos\alpha = 0$

$\Sigma M_O^D = F_v \sin\alpha \cdot 1{,}5 - Q \cdot 1{,}1 = 0$

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a) $F_v = \dfrac{Q \cdot 1{,}1}{\sin\alpha \cdot 1{,}5}$

$\boxed{F_v = 1147{,}79\,N}$

b) $N = F_v \cos\alpha + Q$

$\boxed{N = 1940{,}75\,N}$

c) $F_{tr} = F_v \sin\alpha$

$\boxed{F_{tr} = 916{,}6\,N}$

d) $F_{tr} = N\mu$

$\mu = \dfrac{F_{tr}}{N}$ $\boxed{\mu = 0{,}47}$

11.76) $m, R$ – točak bicikla

$h$ – visina bankine

$F$ – sila kojom djeluje na točak

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a) $\sqrt{R^2 - (R-h)^2} = \sqrt{2Rh - h^2}$

$F = mg \dfrac{\sqrt{2Rh - h^2}}{R - h}$

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b)

$F' = mg \dfrac{\sqrt{2Rh - h^2}}{2R - h}$

c) Manja sila je potrebna u drugom slučaju (kad delujemo silom na vrh točka)