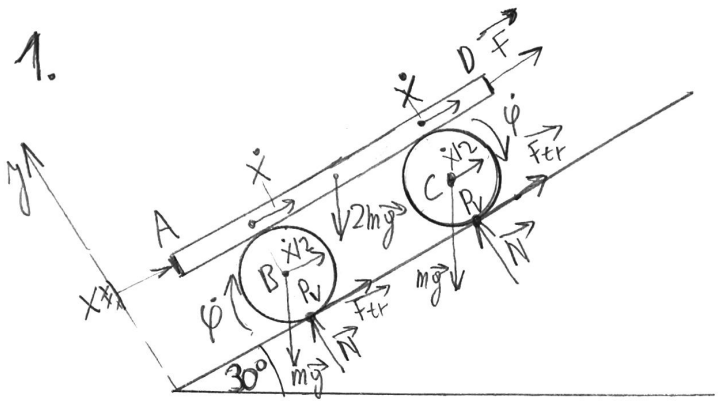
ВЛАДИМИР ИВКОВИЋ 151/18

ДОМАЋИ ЗАДАТАК УЗ ВЕЖБУ 6

1.



B: m, R

C: m, R

$\alpha = 30°$

AD: $2m$

$F = 4mg$

$$R\dot{\varphi} = \frac{\dot{x}}{2} \Rightarrow \dot{\varphi} = \frac{\dot{x}}{2R}$$

$$\delta A = F\delta x - mg\cos 60° \cdot \frac{\delta x}{2} - mg\cdot\cos 60°\frac{\delta x}{2} - 2mg\cos 60°\delta x$$

$$\delta A = 4mg\delta x - \frac{1}{4}mg\delta x - \frac{1}{4}mg\delta x - mg\delta x$$

$$\delta A = \frac{5}{2}mg\delta x \Rightarrow \boxed{Q_x = \frac{5}{2}mg}$$

$$T = T(B) + T(C) + T(AD) \Rightarrow T(B) = \frac{1}{2}m\left(\frac{\dot{x}}{2}\right)^2 + \frac{1}{2}\left(\frac{1}{2}mR^2\right)\cdot\left(\frac{\dot{x}}{2R}\right)^2$$

$$T(C) = \frac{1}{2}m\left(\frac{\dot{x}}{2}\right)^2 + \frac{1}{2}\left(\frac{1}{2}mR^2\right)\cdot\left(\frac{\dot{x}}{2R}\right)^2$$

$$T(AD) = \frac{1}{2}\cdot(2m)\cdot\dot{x}^2$$

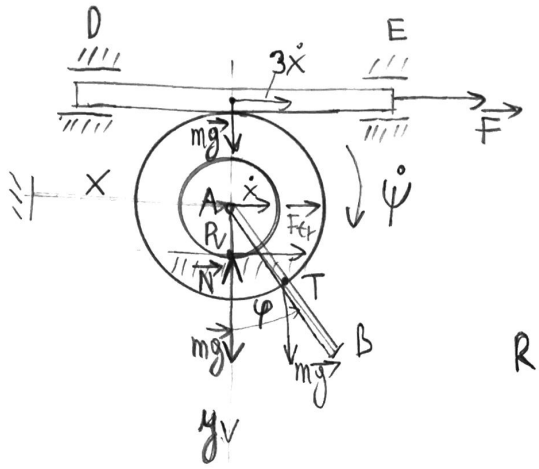
$$\Rightarrow T = \frac{1}{8}m\dot{x}^2 + \frac{1}{16}m\dot{x} + \frac{1}{8}m\dot{x}^2 + \frac{1}{16}m\dot{x}^2 + m\dot{x}^2$$

$$\boxed{T = \frac{11}{8}m\dot{x}^2}$$

$$\Rightarrow \frac{d}{dT}\frac{\partial T}{\partial \dot{x}} - \cancel{\frac{\partial T}{\partial x}}^{\,0} = Q_x$$

$$\frac{d}{dt}\left(\frac{11}{4}m\dot{x}\right) = \frac{5}{2}mg \Rightarrow \frac{11}{4}m\ddot{x} = \frac{5}{2}mg \Rightarrow \boxed{\ddot{x} = \frac{10}{11}g}$$

2.



A: $R, 2R, m, i = R$

AB: r, m

DE: L, m

$F = 3mg$

$R\dot{\psi} = \dot{x} \Rightarrow \boxed{\dot{\psi} = \frac{\dot{x}}{R}}$

$x_T = x + \frac{r}{2}\sin\varphi \Rightarrow \boxed{\dot{x}_T = \dot{x} + \frac{r}{2}\dot{\varphi}\cos\varphi}$

$y_T = \frac{r}{2}\cos\varphi \Rightarrow \boxed{\dot{y}_T = -\frac{r}{2}\dot{\varphi}\sin\varphi}$

$v_T^2 = \dot{x}_T^2 + \dot{y}_T^2$

$\boxed{v_T^2 = \dot{x}^2 + \frac{r^2\cdot\dot{\varphi}^2}{4} + r\dot{x}\dot{\varphi}\cos\varphi}$

$\delta A = F\cdot 3\delta x + mg\,\delta y_T$

$\delta A = 9mg\delta x + mg\cdot(-\frac{r}{2}\sin\varphi\,\delta\varphi)$

$\delta A = 9mg\delta x - \frac{1}{2}mgr\sin\varphi\,\delta\varphi$

$\Rightarrow \boxed{Q_x = 9mg \quad Q_\varphi = -\frac{1}{2}mgr\sin\varphi}$

$T = T(A) + T(AB) + T(DE) \Rightarrow T(A) = \frac{1}{2}m\dot{x}^2 + \frac{1}{2}(mR^2)\cdot\left(\frac{\dot{x}}{R}\right)^2$

$T(DE) = \frac{1}{2}m\cdot(3\dot{x})^2$

$T(AB) = \frac{1}{2}\left(\frac{1}{12}mr^2\right)\dot{\varphi}^2 + \frac{1}{2}m\cdot v_T^2$

$\Rightarrow \boxed{T = 6m\dot{x}^2 + \frac{1}{6}mr^2\dot{\varphi}^2 + \frac{1}{2}mr\dot{x}\dot{\varphi}\cos\varphi}$

$\frac{d}{dt}\frac{\partial T}{\partial \dot{x}} - \frac{\partial T}{\partial x}^{0} = Q_x$

$\frac{d}{dt}(12m\dot{x} + \frac{1}{2}mr\dot{\varphi}\cos\varphi) = 9mg$

$12m\ddot{x} + \frac{1}{2}mr\ddot{\varphi}\cos\varphi - \frac{1}{2}mr\dot{\varphi}^2\sin\varphi = 9mg \,/\cdot 2$

$\boxed{24\ddot{x} + r(\ddot{\varphi}\cos\varphi - \dot{\varphi}^2\cdot\sin\varphi) = 18g}$ ①

↘

$$\frac{d}{dt}\cdot\frac{\partial T}{\partial \dot{\varphi}} - \frac{\partial T}{\partial \varphi} = Q_\varphi$$

$$\frac{d}{dt}\left(\frac{1}{3}mr^2\dot{\varphi} + \frac{1}{2}mr\dot{x}\cos\varphi\right) - \left(\frac{1}{2}mr\dot{x}\dot{\varphi}(-\sin\varphi)\right) = -\frac{1}{2}mgr\sin\varphi$$

$$\frac{1}{3}mr^2\ddot{\varphi} + \frac{1}{2}mr\ddot{x}\cos\varphi - \frac{1}{2}mr\dot{x}\dot{\varphi}\sin\varphi + \frac{1}{2}mr\dot{x}\dot{\varphi}\sin\varphi = -\frac{1}{2}mgr\sin\varphi \;/\cdot 6$$

$$\boxed{2r^2\ddot{\varphi} + 3r\ddot{x}\cos\varphi = -3gr\sin\varphi} \quad (2)$$