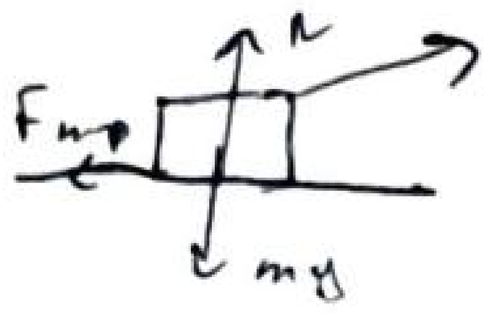
Задача 1.А.

а)



$$F = mg\frac{t}{\tau}$$

$$F_{тр} = \mu N$$

$$\begin{cases} mg = N + mg\frac{t}{\tau}\sin\alpha & (1) \\ mg\frac{t}{\tau}\cos\alpha - \mu N = ma & (2) \end{cases}$$

из (1), (2): $a = g\left(\frac{t}{\tau}(\cos\alpha + \mu\sin\alpha) - \mu\right)$

$t_0 = \tau \cdot \frac{\mu}{\cos\alpha + \mu\sin\alpha}$ – время начала движения.

$N = 0 \Rightarrow mg = mg\frac{t}{\tau}\sin\alpha \rightarrow t_1 = \frac{\tau}{\sin\alpha}$ – время отрыва

$$\boxed{\Delta t = t_1 - t_0 = \tau\left(\frac{\cos\alpha}{\sin^2\alpha\,\mu + \cos\alpha\sin\alpha}\right)}$$

б)

$$a(t) = a(t' + t_0) = g\left(\frac{t'}{\tau}(\cos\alpha + \sin\alpha\,\mu)\right)$$

$$v(t') = \int_0^{\Delta t} a(t')\,dt'$$

$$\boxed{L = \int_0^{\Delta t} v(t')\,dt' = \frac{g(\cos\alpha + \mu\sin\alpha)}{\tau} \cdot \frac{\Delta t^3}{6}}$$

2)

Задача 1Б

а) $PV^n = const \Rightarrow \frac{dP}{P} + n\frac{dV}{V} = 0$

$\partial Q = dU + \partial A = \frac{i}{2} R\, dT + P\, dV$

$PV = \nu RT \rightarrow P dV + dP V = \nu R\, dT$

$\partial Q = P\, dV + \frac{i}{2}(P dV + dP V) = P\, dV\left(1 + \frac{i}{2} - n\right)$

$1 + \frac{i}{2} > n \Rightarrow$ $\boxed{n > \frac{i+2}{2} = \frac{7}{2}}$

б)

$P dV - n P dV = \nu R\, dT$

$dV\, P(1-n) = \nu R\, dT$

$1 - n > 0$

$\boxed{n < 1}$

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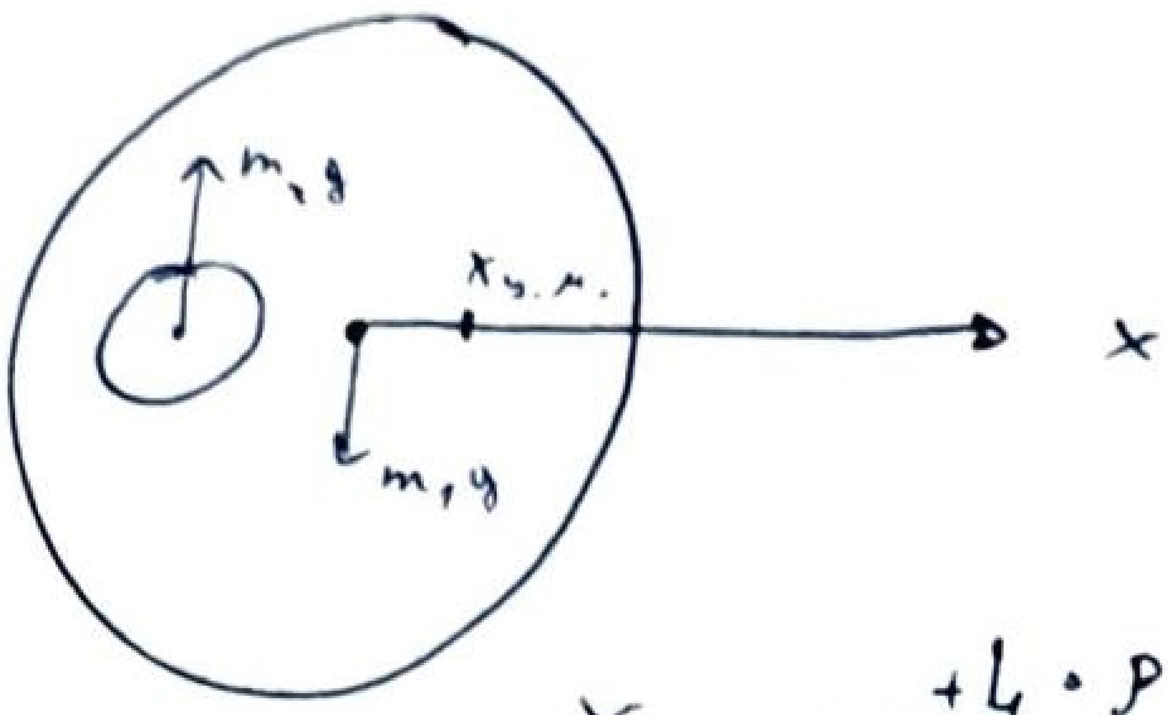
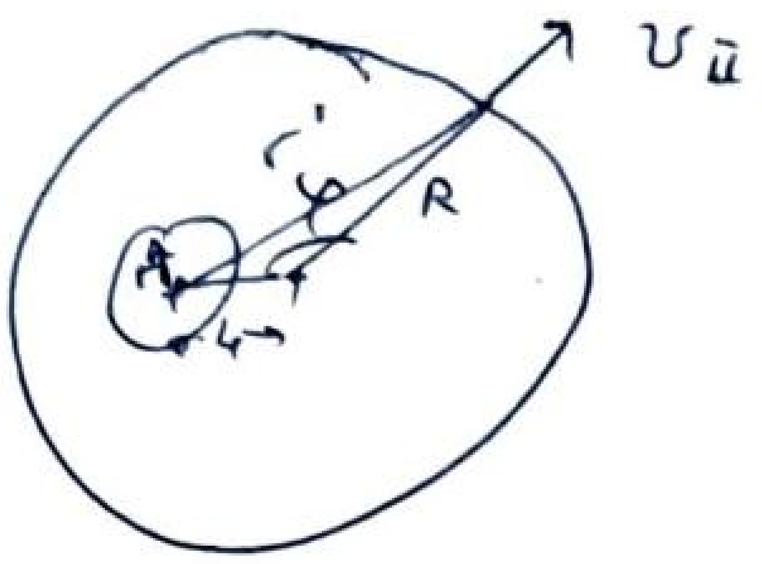
задача 12

a)



$$x_{ц.м.} = \frac{+L\cdot\rho\cdot\frac{4}{3}\pi r^3}{\rho\frac{4}{3}\pi(R^3-r^3)} = L\frac{r^3}{R^3-r^3}$$

б)



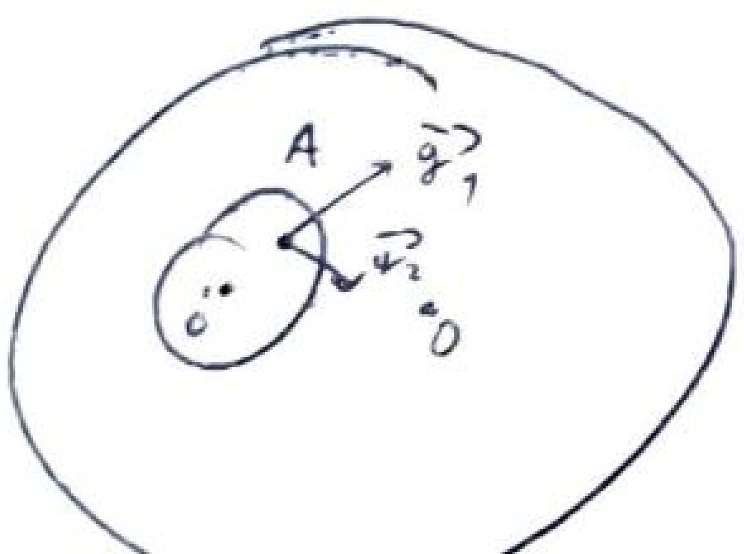
$$r'^2 = R^2 + L^2 - 2RL\cos\varphi$$

$$\frac{mv_{II}^2}{2} - G\frac{m}{R}\rho\frac{4}{3}\pi R^3 + G\,m\,\frac{\rho\frac{4}{3}\pi r^3}{r'} = 0.$$

$$v_{II} = \sqrt{\frac{8}{3}\pi\rho G\left(R^2 - \frac{r^3}{r'}\right)}$$

$$r' = \sqrt{R^2+L^2-2RL\cos\varphi}$$

в)



$$\begin{cases}\vec g_1 = -4\pi G\rho\dfrac{\vec{O'A}}{3}\\ \vec g_2 = +4\pi G\rho\dfrac{\vec{OA}}{3}\end{cases} \Rightarrow \vec g_1 + \vec g_2 = \frac{4\pi G\rho L}{3} = g_0$$

$$\frac{g_0 t^2}{2} = 2r$$

$$t = \sqrt{\frac{4r\cdot 3}{4\pi G\rho L}} = \sqrt{\frac{3r}{\pi G\rho L}}$$

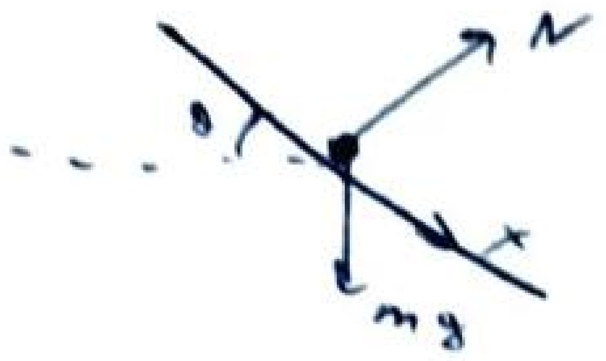
№ 3 задача

a)

$$\frac{d\varphi}{dt} = IR = \frac{d(B \cdot L\, v \cos\theta\, dt)}{dt} = BLv\cos\theta$$

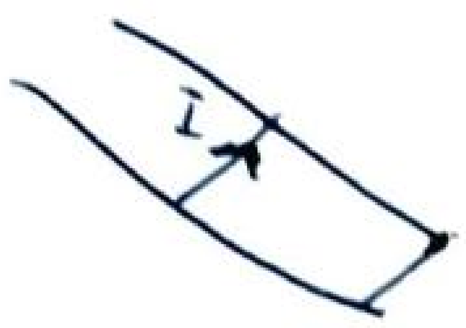
$$\boxed{I = 0}$$

б)



$$F_x = mg \cdot \sin\theta$$

c) ~~ток~~ по правилу правой руки:



g)

$$F = mg\sin\theta = BLI = BL \cdot BL\frac{v_0\cos\theta}{R}$$

$$\boxed{v_0 = \frac{mg\,tg\theta\, R}{(BL)^2}}$$

e)

$$mg\sin\theta - \frac{(BL)^2}{R}\cos\theta\, v = m\frac{dv}{dt}$$

$$1 - \frac{v}{v_0} = \frac{dv}{dt}\cdot\frac{1}{g\sin\theta}$$

$$\boxed{v = v_0\left(1 - e^{-\frac{g\sin\theta\, t}{v_0}}\right)}$$