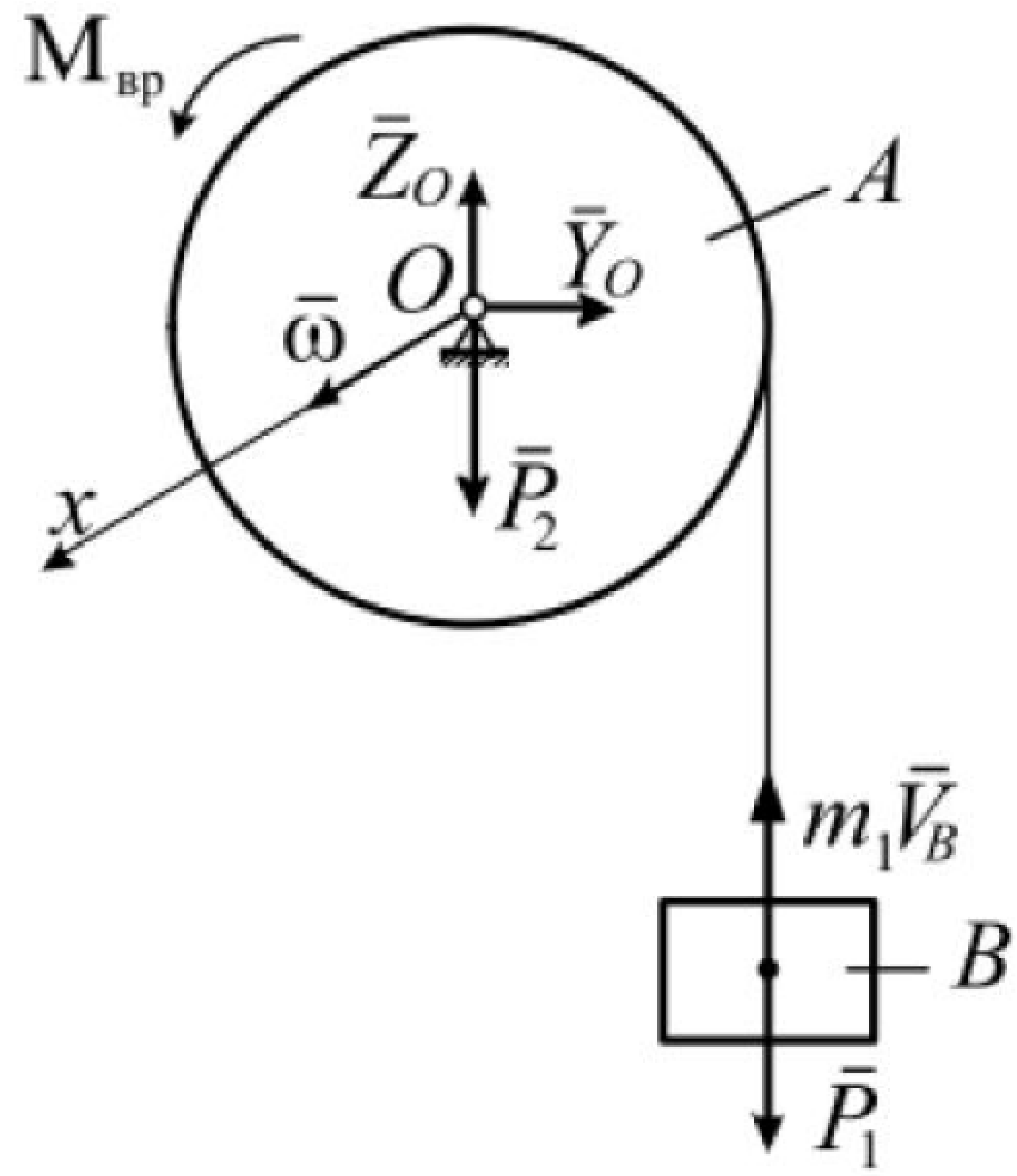
Body A (radius r, mass m_2) has a torque $M_r = \alpha t$, where $\alpha = const$. B body has a mass m_1. It goes up. We need to find angular velocity if A is just a uniform cylinder.
Initial conditions: $t = 0,\ \omega_0 = 0$.



Answer: $\omega = \frac{t(\alpha t - 2m_1 g r)}{r^2(m_2 + 2m_1)}$

HINTS:

1) Ahtung! Different notations
   Q - Linear momentum
   K - linear, angular momentum
   L - angular (sic!) momentum

Be aware! It's a good practice to write a legend

2) $L = M_0(Q) = Q \times R$
   Angular   Linear

3) $L = J_0 \omega$
   Inertia

4) Change inertia for other point.
Example: know J_0
need $J_K \to J_K = J_0 + m(0K)^2$

5) Need to choose 1 point $\frac{dL}{dt} = \Sigma M$

Research Object:
System, consists of A - Disk, B - block

Motion:
A - rotation motion, B - translatory motion

Conditions:

initial	final
$t = 0$	$t - ?$
$\varphi = 0$	$\varphi - ?$
$\dot\varphi = 0$	$\dot\varphi - ?$

Force Analysis: $\bar{P}_1 = m_1 g$; $\bar{P}_2 = m_2 g$; $M_r = \alpha t$
$Z_0 = R_z$; $Y_0 = R_y$;

point

Solution: $\frac{dL}{dt} = \Sigma M \Rightarrow x: \frac{dL_x}{dt} = \Sigma M_x^0$

$\frac{d}{dt}\{L_x^A + L_x^B\}$; $L_x^A = J\omega = \frac{m_2 r^2}{2}\omega$; $L_x^B = Q \times R = m_1 V_r^B = m_1 r^2 \omega$

$= \alpha t - m g r \Rightarrow \omega$