Task 1:

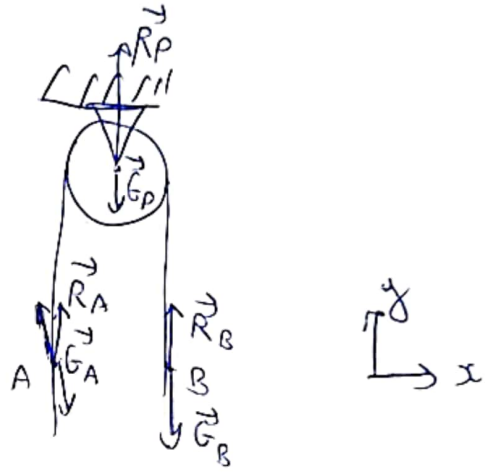
Research object:

- Rope
- Pulley
- Load B } rectilinear
- Man A }

Force analysis

$\vec{G}_A$; $\vec{G}_B$; $\vec{G}_P$

$\vec{R}_A$; $\vec{R}_B$; $\vec{R}_P$



Solution: $J = \frac{m r^2}{4}$; $V_B = \omega r$

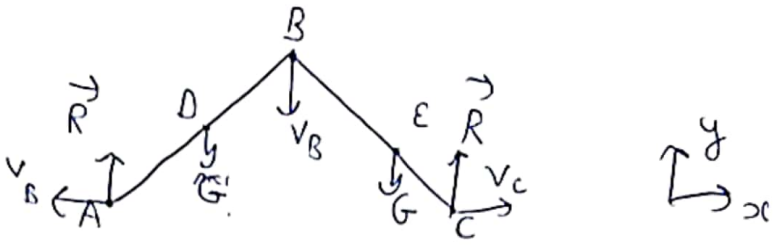
$$m V_B r + m (V_B - V) \cdot r + \frac{m}{4} r^2 \omega = 0$$

$$\Rightarrow V_B \cdot r + (V_B - V) + \frac{1}{4} V_B = 0$$

$$\Rightarrow V_B = \frac{4}{9} V$$

$\Rightarrow$ Load will go up B with velocity $\frac{4}{9} a$

Task 2:



R.O:

* rod AB
* rod BC

} plane motion

Force analysis
$\vec{G_D}$, $\vec{G_C}$
$\vec{R_A}$, $\vec{R_C}$

First part:

Positions:

	initial	final
x_B	0	0
y_B	h	0
x_C	$\sqrt{4l^2-h^2}$	$\sqrt{4l^2-h^2}+h$
y_C	0	0
x_a	$-\sqrt{4l^2-h^2}$	$-\sqrt{4l^2-h^2}-h$
y_a	0	0

Solution:

$$T_{AB} = \frac{1}{2} I \omega_{AB}^2 = T_{BC} = \frac{1}{2} I \omega_{BC}^2$$

$$I = m l^2 + m \rho^2$$

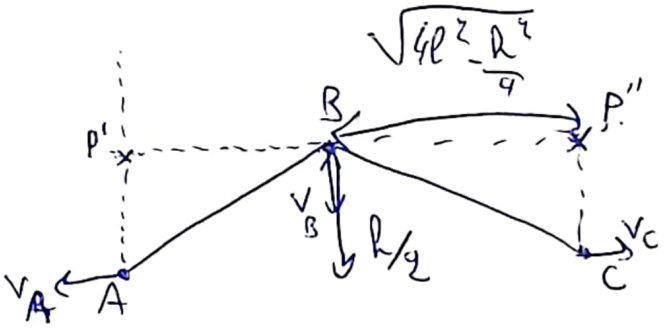
Using IC of AB at A and BC at C (final position):

$$V_B = \omega_{AB} \cdot 2l = \omega_{BC} \cdot 2l$$

Work: $A_{if} = mg\frac{h}{2} + mg\frac{h}{2} \Rightarrow \omega^2 I = mgh \quad (T_{AB} + T_{BC} = A)$

$$\Leftrightarrow \frac{V_B^2}{4l^2}\left(m l^2 + m \rho^2\right) = mgh \Leftrightarrow \boxed{V_B = 2l\sqrt{\frac{gh}{l^2+\rho^2}}}$$

Second part :



P' and P'' are IC ..

$$\Rightarrow V_B = \omega_{AB}\sqrt{4l^2-\frac{h^2}{4}} = \omega_{BC}\sqrt{4l^2-\frac{h^2}{4}}$$

Work: $A_{if} = \Delta K = mg\frac{h}{2} = T_{AB}+T_{BC} =$

$$= \frac{1}{2}I\omega^2 = \left(ml^2+mp^2\right)\frac{V_B^2}{4l^2-\frac{h^2}{4}}$$

$$\Rightarrow V_B = \frac{1}{2}\sqrt{16l^2-h^2}\sqrt{\frac{gh}{2(l^2+p^2)}}$$