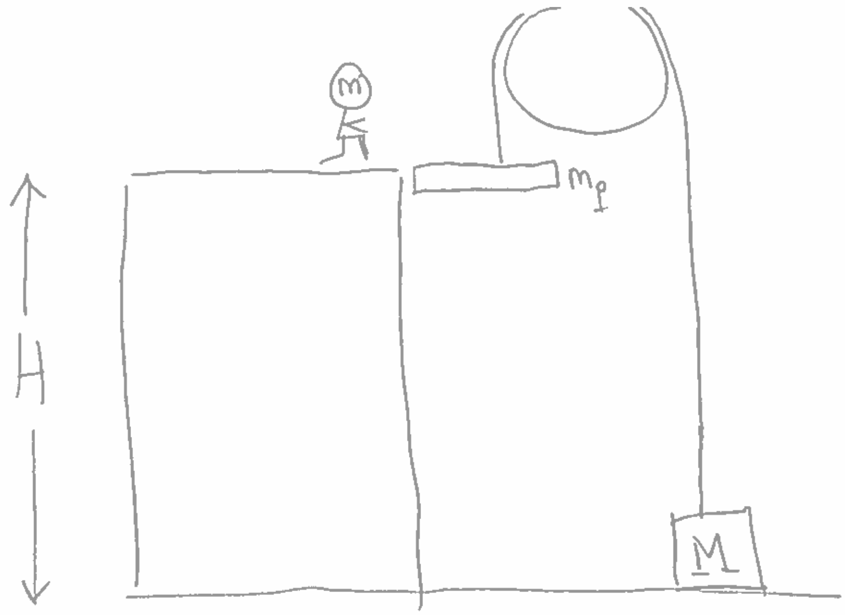
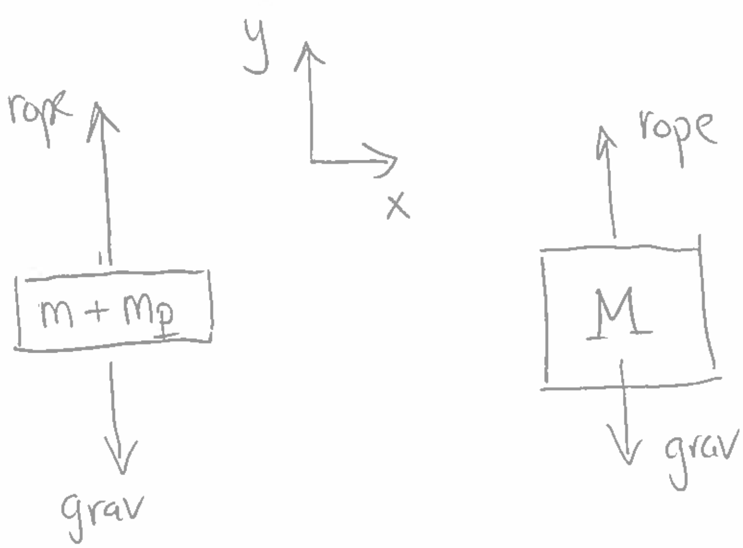


Carl stands on building of height H. He will step onto a platform of mass m_p, which hangs from the left end of an ideal rope. Rope passes over ideal pulley, then is attached to a pile of bricks of mass M.



After Carl, of mass m, steps onto the platform, what happens?

Draw free-body diagram of Carl+platform, and bricks.

force	x	y
grav	0	$-(m_p+m)g$
rope	0	$+T$
total	$(m+m_p)a_x$ $=0$	$-(m+m_p)a_y$ ↑ must be negative

force	x	y
grav	0	$-Mg$
rope	0	$+T$
total	Ma_x $=0$	$+Ma_y$ ↑ must be positive

Since Carl+platform has more mass, it will accel <u>down</u>, while bricks will accel <u>up</u>.

Thus, we can assign the proper ⊕ or ⊖ sign to the total terms.

And now we have 2 equations for two unknowns:

$$-(m+m_p)g + T = -(m+m_p)a_y$$

$$-Mg + T = +Ma_y$$

First, substitute to get rid of unknown T.

$$T = Ma_y + Mg$$

$$\rightarrow \quad -(m+m_p)g + Ma_y + Mg = -(m+m_p)a_y$$

Now solve for a_y.

$$(m+m_p+M)a_y = (m+m_p-M)g$$

$$\rightarrow \quad a_y = \frac{(m+m_p-M)}{(m+m_p+M)}g$$

The tension is then

$$T = Ma_y + Mg = \left[\left(\frac{m+m_p-M}{m+m_p+M}\right)+1\right]Mg$$

To find final velocity V_f as platform reaches ground, use

$$V_f^2 - V_i^2 = 2a_yH$$

$$\rightarrow \quad V_f = \sqrt{2a_yH}$$