Given

4) Length = 0.15 m
Height = 0.05 m

1 rigid bar
3 pin supports (2 on ground)
1 linear actuator

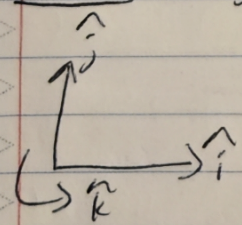
Find

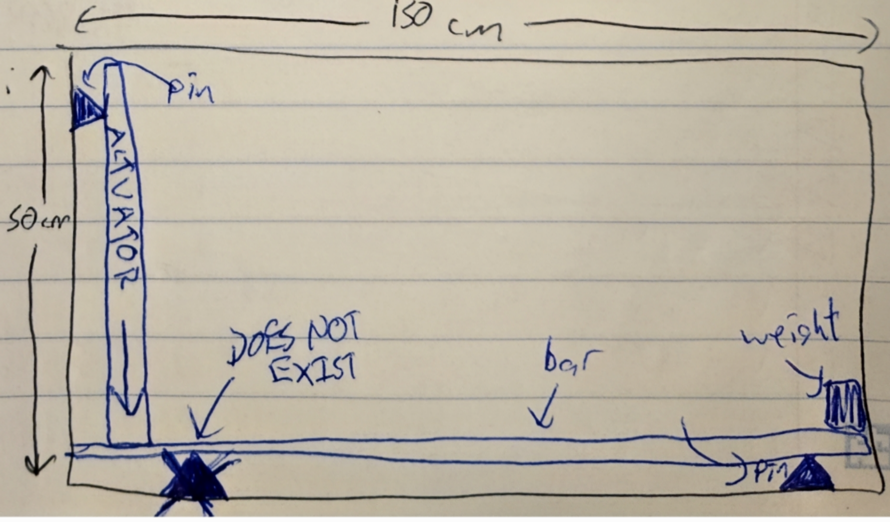
Frame/mechanism to lift maximum weight to maximum height

Plan

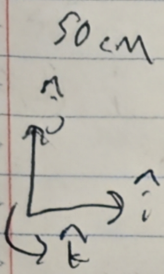
1) Have the bar of length 0.15 m
2) Connect the bar to the ground via a pin in the central region of the ground
3) Connect the actuator to the ceiling of the "box" via a pin on the left top corner of the region
4) The weight should be placed on the far right of the bar → this creates a lever mechanism to lift the weight
5) To calculate weight ~~[illegible]~~, balance moments about the pin on the ground (which will be the moments created by actuator and weight) (max weight lifted)
6) To calculate max height, calculate the height above the ground that the pin will start/finish at (i.e. stable vs unstable equilibrium

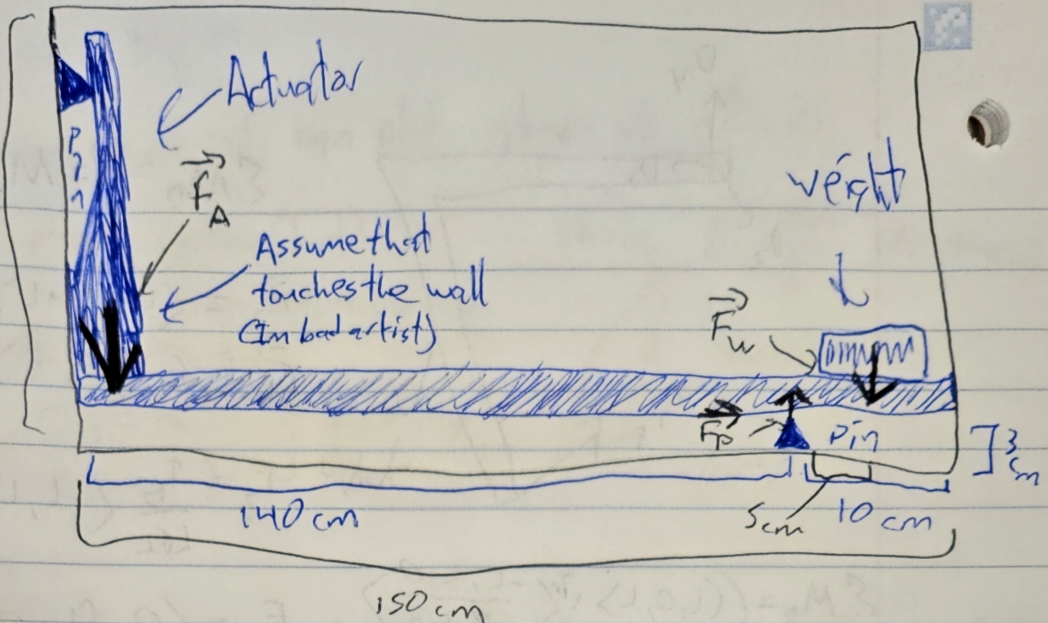
Solve FBD:





Solve





$|\vec{F}_A|$ (from catalog) $= 294\,kN$ ⟵ High Force Rod Style Actuator

$\vec{F}_A = -294\,kN\,\hat{j}$; $\vec{r}_A = -0.14\,m\,\hat{i}$; $\vec{F}_w = ?\,\hat{j}$; $\vec{r}_w = 0.05\,m\,\hat{i}$

$$\sum M_p = 0 = (-0.14\,m\,\hat{i} \times -294\,kN\,\hat{j}) + (0.05\,m\,\hat{i} \times F_w\,\hat{j})$$

$\boxed{F_w = -823.2\,kN\,\hat{j}}$ $\quad \Delta H_A = |H_{f_A} - H_{i_A}|$; $H_i = 0.03\,m$

$H_f = 0.00\,m$

$H_f = H_i + \Delta H_w = \boxed{0.06\,m}$ $\quad \Delta H_A = 0.03\,m$; $\boxed{\Delta H_w = 0.03\,m}$

This mechanism can lift a weight up to 823.2 kN to a height of 0.06 m

Reflection: Given the much greater moment arm on the actuator compared to the applied weight, as well as the (assumed) height of the pins, as well as the high applied force from the actuator, an extremely high weight (with correspondingly low ΔH) makes sense in this situation.