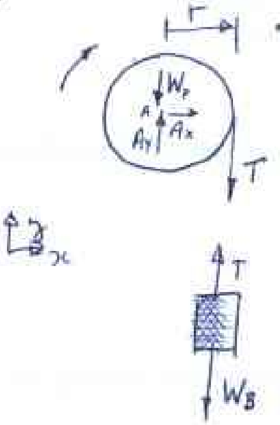
Alternative approach to pulley & block problem

in class, an impulse & momentum approach was followed but there are other ways to solve problem

Again, DRAW F.B.D. for Block & for pulley



W_p is weight of pulley

T is tension in cord

W_B is weight of block

for pulley $\Sigma M_A = I_A \alpha$

$\Rightarrow$ (+) $Tr = I_A \alpha$

& $T = \frac{I_A \alpha}{r}$ (*)

for block $\Sigma F_y = m a_y$ $\downarrow +$ $\Rightarrow W_B - T = m a_y$

note $W_B = mg$ $\Rightarrow T = W_B - m a_y$ (Q)

note, from kinematics that a_y for block is related to α

$a_y = r\alpha$ & $\alpha = \frac{a_y}{r}$ subst into (*)

$\Rightarrow$ $T = \frac{I_A a_y}{r^2}$ (P)

equate (P) & (Q) $\frac{I_A a_y}{r^2} = W_B - m a_y$

$$\Rightarrow a_y = \frac{W_B}{\left(\frac{I_A}{r^2} + m\right)} = \frac{(6)(9.81)}{\frac{0.4}{(0.2)^2} + 6} = 3.68 \, m s^{-2}$$

$V_{B_2} = V_{B_1} + at$

$= 2 + (3.68)(3)$

note that this is effectively an integration

$\boxed{V_{B_2} = 13.04 \; m/s}$ same answer