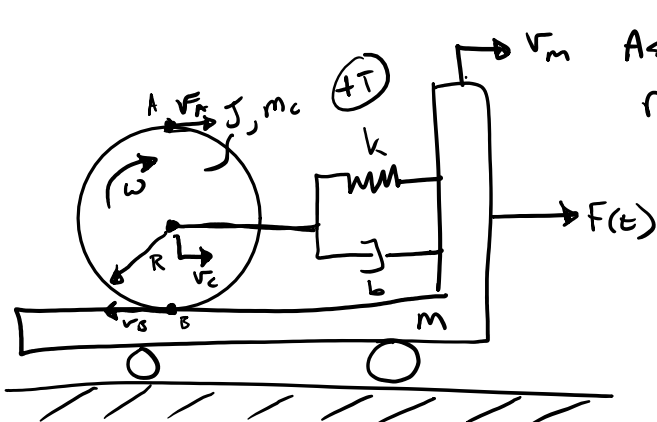


# Rotation + Translation



Assume no slip rolling of disc on cart.

$$v_A = v_c + \omega r$$

$$v_B = v_c - \omega r$$

$v_B = -v_m$  — no slip!

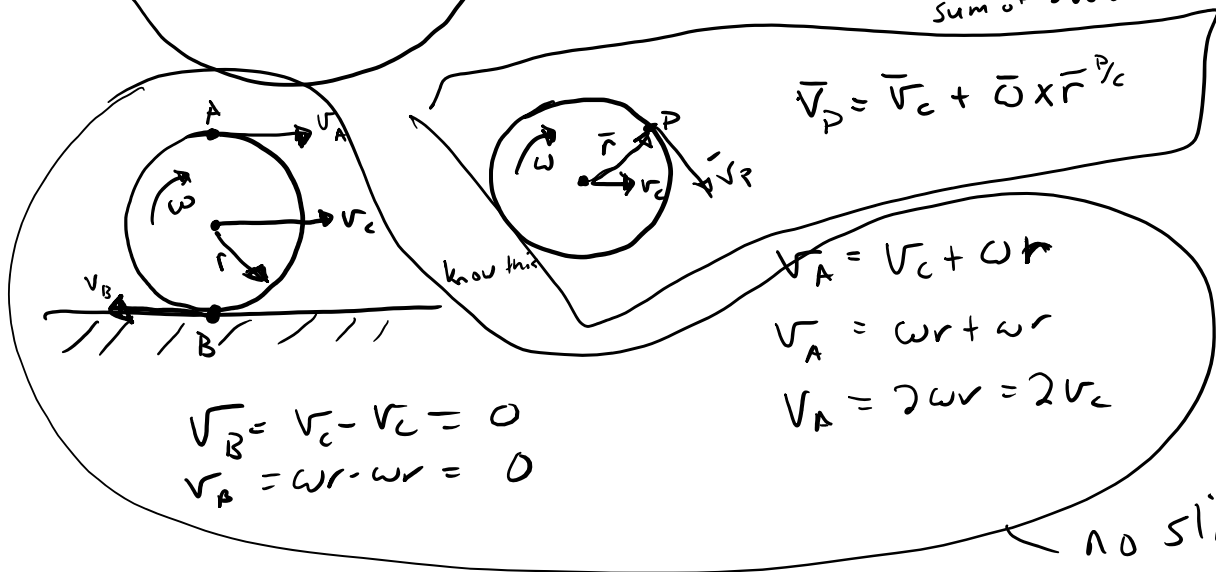
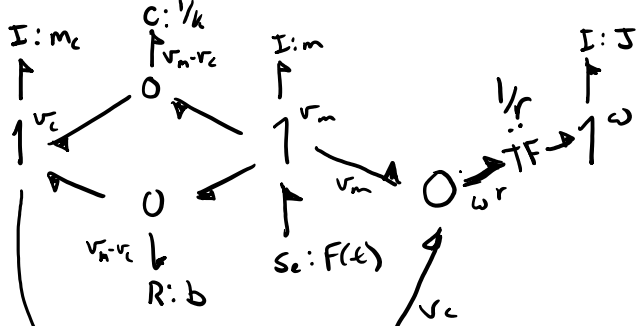
$$-v_m = v_c - \omega r$$

$$v_m = \omega r - v_c$$

Kinematic relationship relationship among velocities

$$v_m + v_c - \omega r = 0$$

Sum of 3 velocities



2 points on rigid body

$$v_A = v_c + \omega r$$

$$v_A = \omega r + \omega r$$

$$v_A = 2\omega r = 2v_c$$

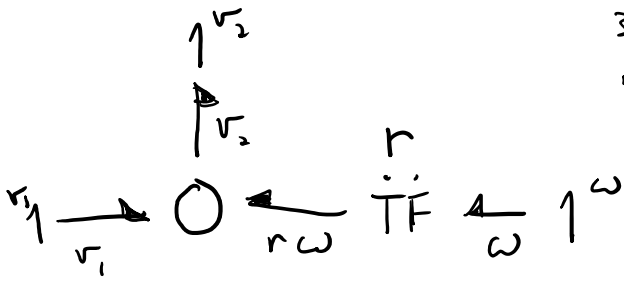
no slip!

## Kinematic relationships

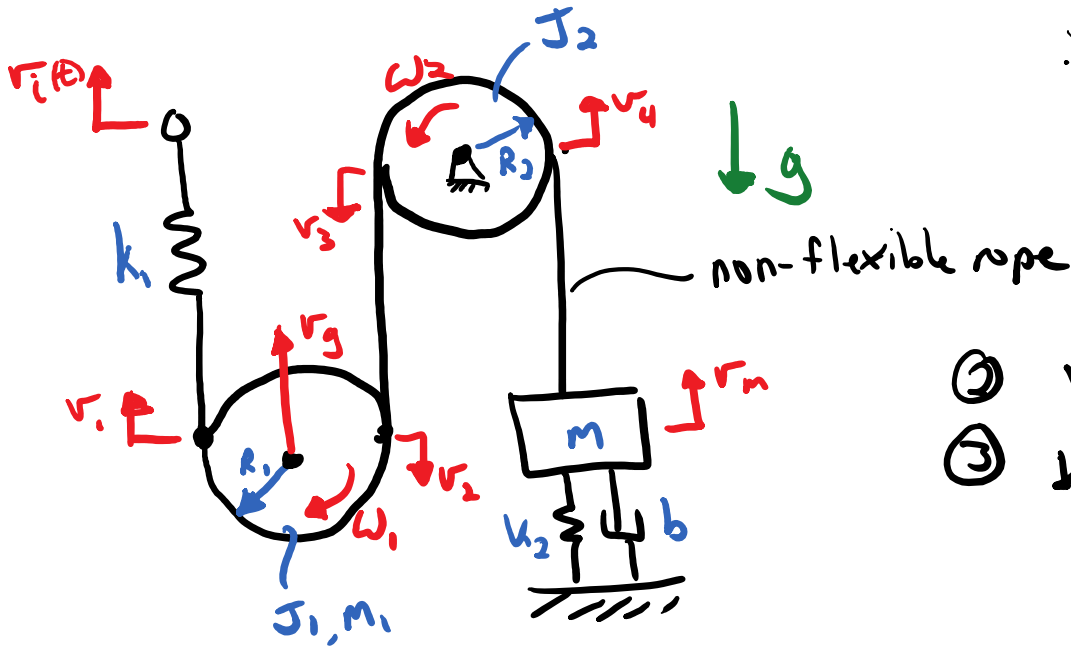
$$v_2 = v_1 + r\omega \Rightarrow v_2 - v_1 - r\omega = 0$$

$\downarrow \quad \downarrow \quad \downarrow$   
 $v_2 \quad v_1 \quad \omega$   
 3 linear velocities

3 linear velocities  
use 0 junction!



# Exercise



①  $v_m = \omega_2 R_2$

$\omega_2 R_2 = \dot{v}_4 = v_3$

$v_4 = v_m$

$v_3 = v_2$

②  $v_1 = v_g + R_1 \omega_1$

③  $v_2 = -v_g + R_1 \omega_1$

