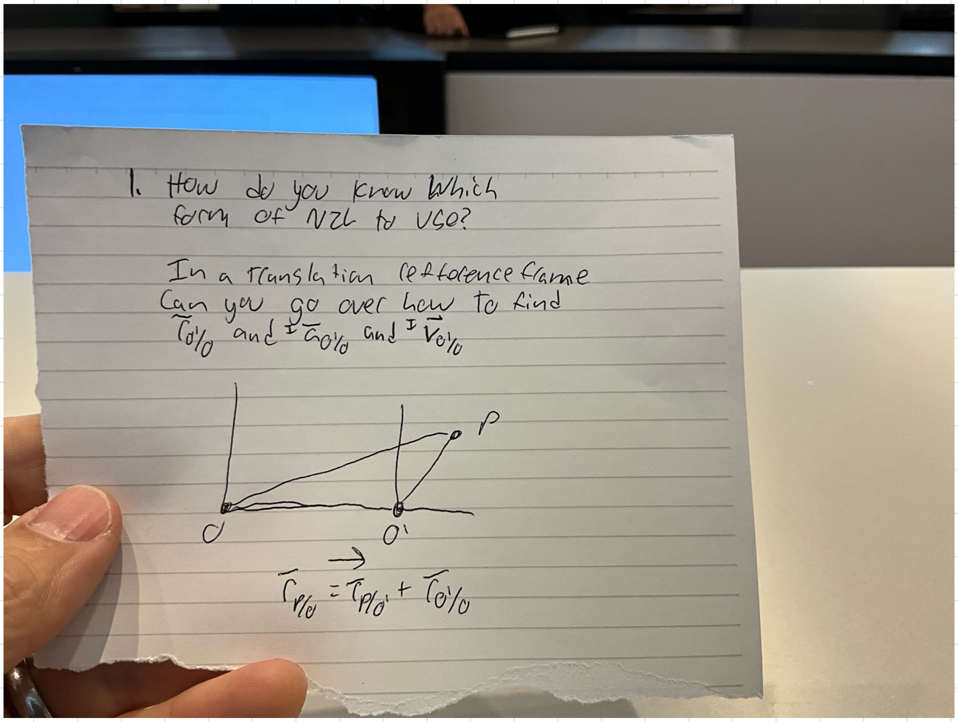
Midterm Review

10/15/24


1. How do you know which form of N2L to use?

In a translation reference frame can you go over how to find $\bar{r}_{O'/O}$ and ${}^I\bar{a}_{O'/O}$ and ${}^I\vec{v}_{O'/O}$

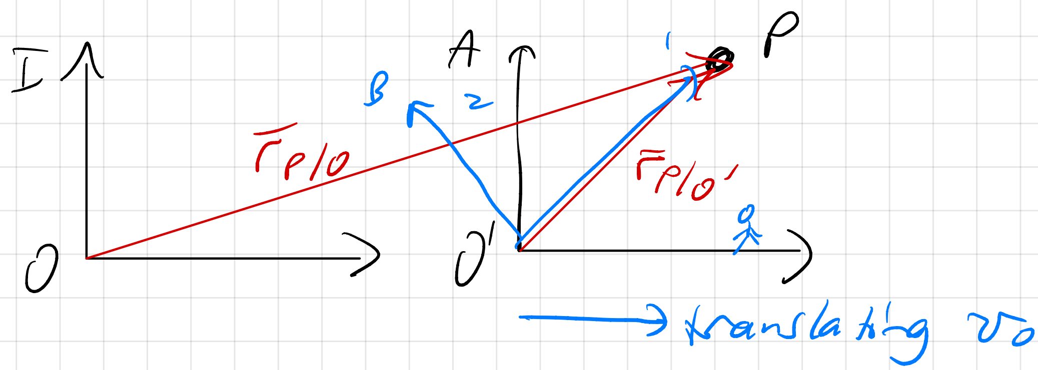
$$\vec{r}_{P/O} = \bar{r}_{P/O'} + \bar{r}_{O'/O}$$

$$\bar{F}_P = m_P\, {}^I\bar{a}_{P/O}$$

$$\frac{{}^I d}{dt}\left({}^I\bar{p}_{P/O}\right) = \bar{F}_P$$

$$\frac{{}^I d}{dt}\left({}^I\bar{h}_{P/O}\right) = \bar{M}_{P/O}$$

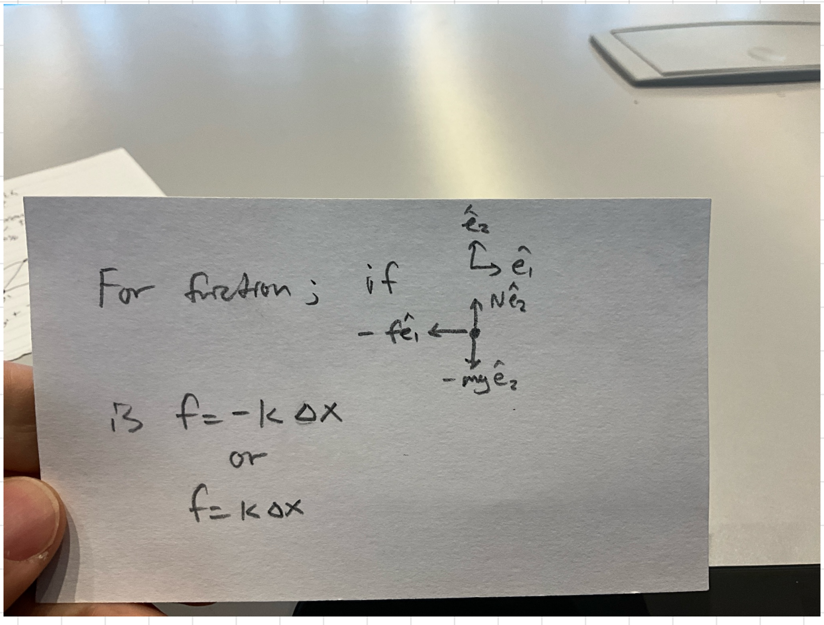
Ch 3



$$\bar{r}_{P/O} = \bar{r}_{O'/O} + \bar{r}_{P/O'}$$

$${}^I\bar{v}_{P/O} = {}^I\bar{v}_{O'/O} + {}^I\bar{v}_{P/O'}$$

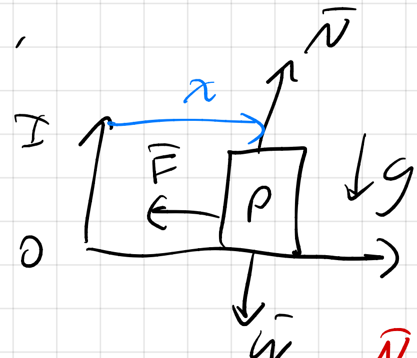
$${}^I\bar{a}_{P/O} = {}^I\bar{a}_{O'/O} + {}^I\bar{a}_{P/O'}$$


For friction; if

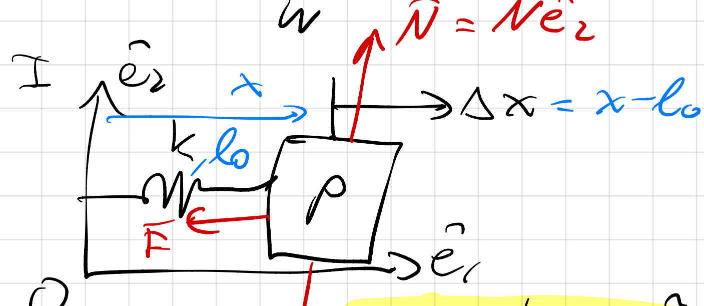
is $f = -k\Delta x$

or

$f = k\Delta x$



$\bar{F} = -\mu N\hat{e}_1$



$\bar{F}_P = -k\Delta x\,\hat{e}_1$

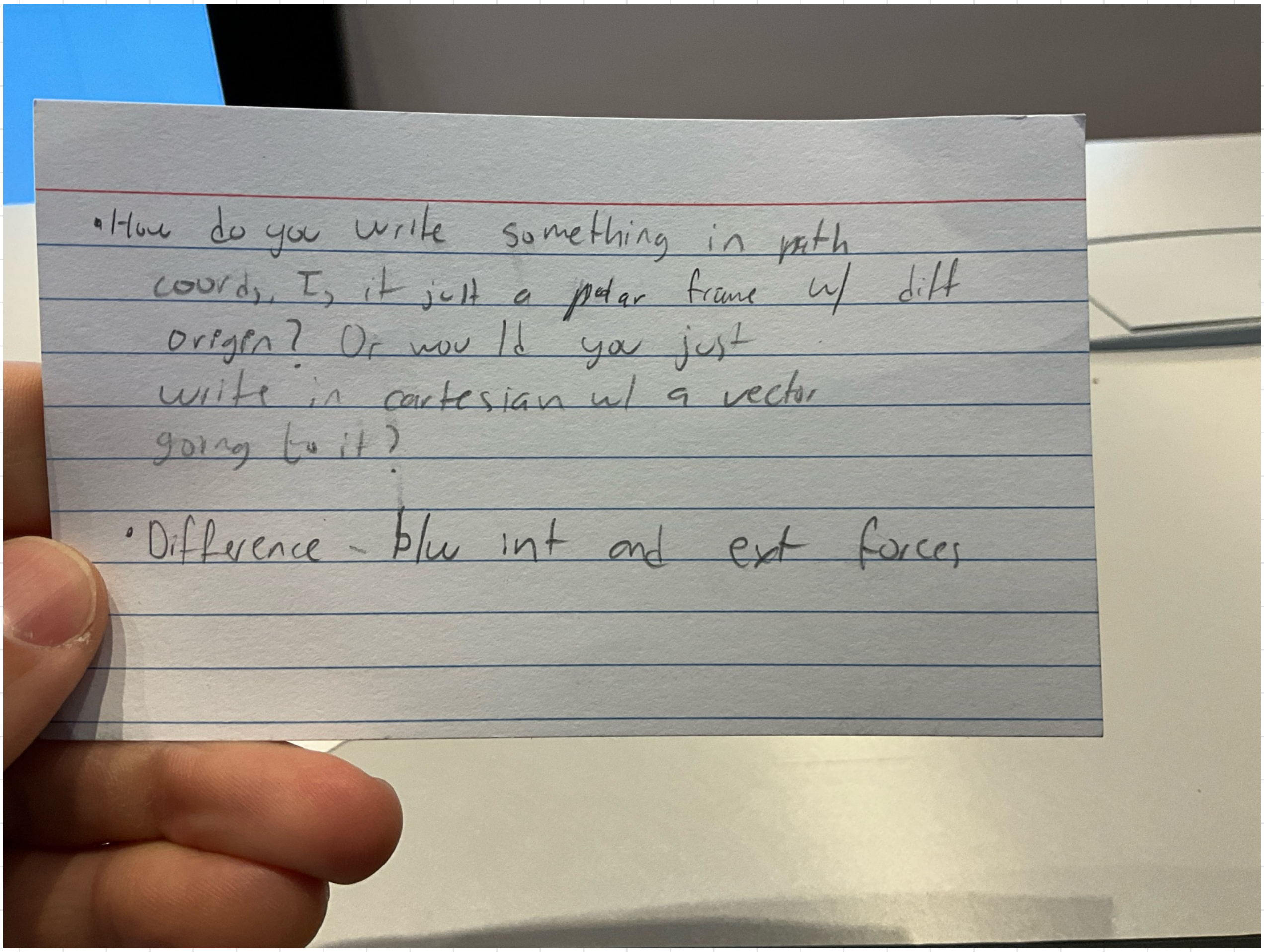
* Friction opposes the motion

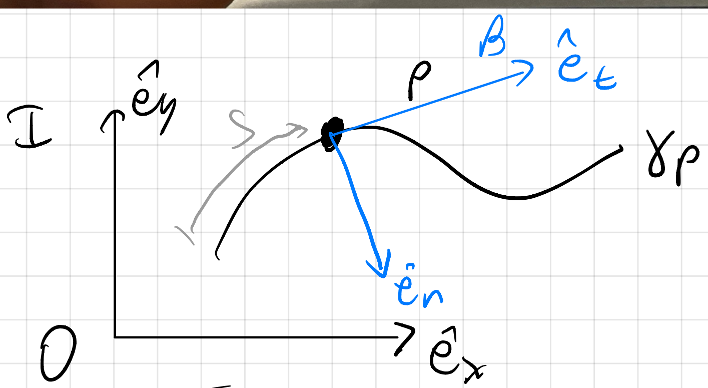
$$\bar{F} = -\mu N \,\mathrm{sign}(\dot{x})\,\hat{e}_1$$

$$\mathrm{sign}(\dot{x}) = \begin{cases} +1, & \dot{x} > 0 \\ 0, & \dot{x} = 0 \\ -1, & \dot{x} < 0 \end{cases}$$

$$\bar{F}_P = m_P \, {}^{I}\bar{a}_{P/O}$$

$$\bar{F} + \bar{N} + \bar{W} = m_P \, {}^{I}\bar{a}_{P/O}$$





$$I = (O, \hat{e}_x, \hat{e}_y, \hat{e}_z)$$

$$B = (P, \hat{e}_t, \hat{e}_n, \hat{e}_3)$$

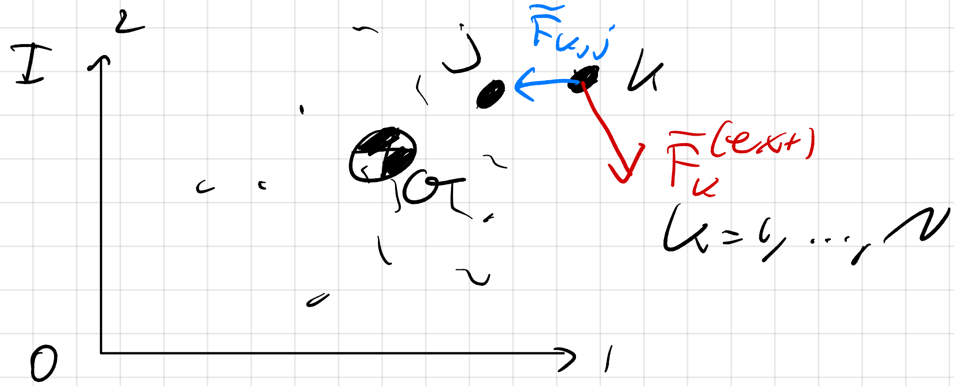
$${}^{I}\bar{v}_{P/O} = \dot{s}\,\hat{e}_t$$

$$\hat{e}_t = \frac{{}^{I}\bar{v}_{P/O}}{\|{}^{I}\bar{v}_{P/O}\|} = {}^{I}\hat{v}_{P/O}$$

$\hat{e}_n$ inward,

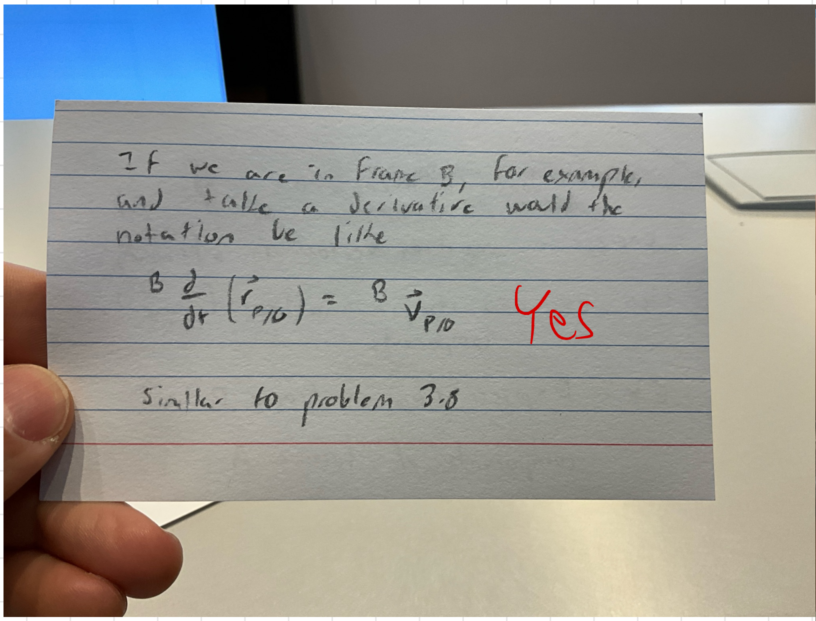
$$\hat{e}_t \times \hat{e}_n = \hat{e}_3$$

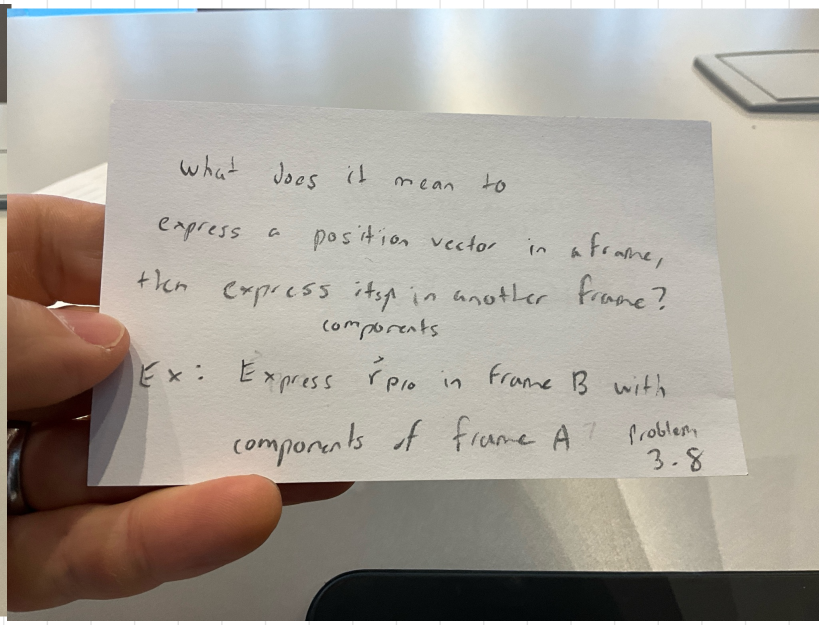
Recall 6.1

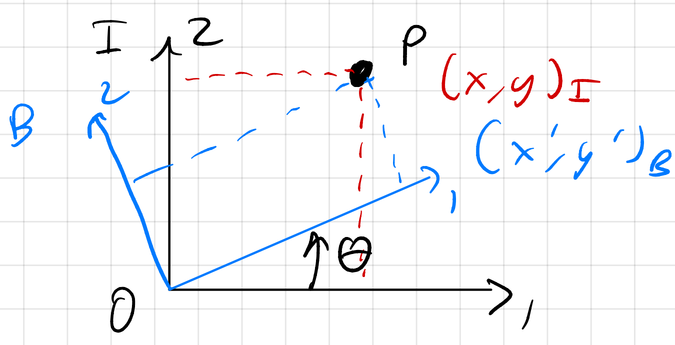


$$\bar F_k = \bar F_k^{(ext)} + \bar F_k^{(int)}$$
$$= \bar F_k^{(ext)} + \sum_{j=1}^{N} \bar F_{k,j}$$

$\bar F_{k,k} = 0$





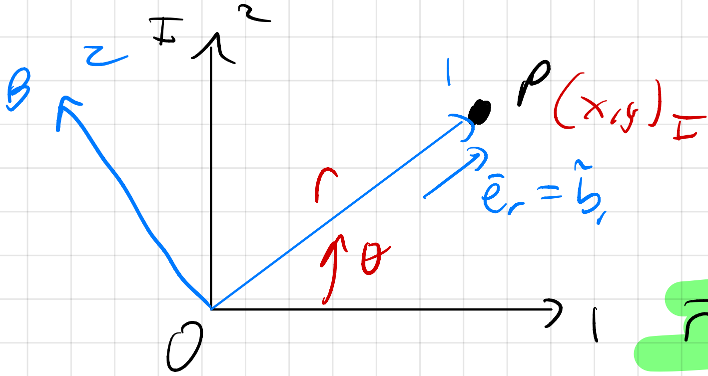


	$\hat b_1$	$\hat b_2$
$\hat e_1$	$c\theta$	$-s\theta$
$\hat e_2$	$s\theta$	$c\theta$

	$\hat b_1$	$\hat b_2$
$\hat e_1$	$\hat e_1 \cdot \hat b_1$	$\hat e_1 \cdot \hat b_2$
$\hat e_2$	$\hat e_2 \cdot \hat b_1$	$\hat e_2 \cdot \hat b_2$

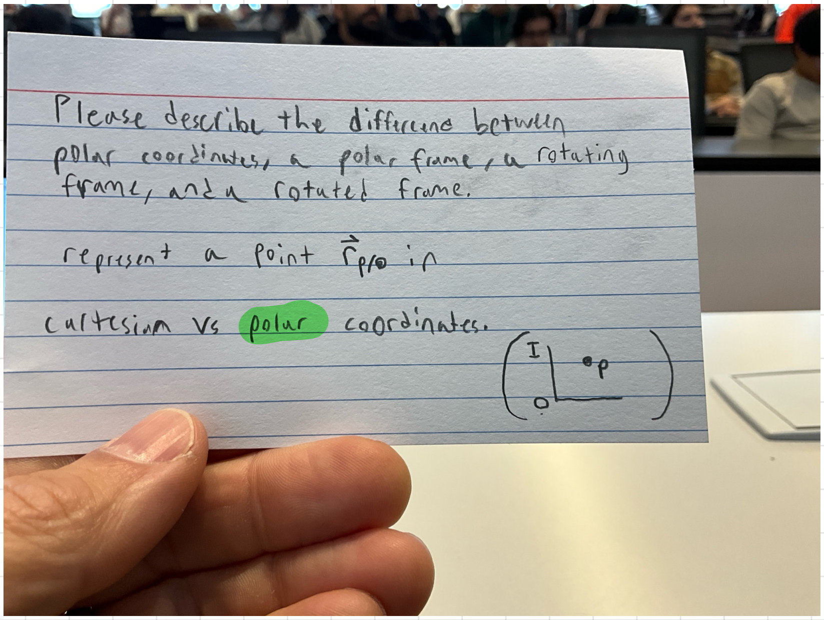
$$\hat b_1 = c\theta\, \hat e_1 + s\theta\, \hat e_2$$
$$\hat b_2 = -s\theta\, \hat e_1 + c\theta\, \hat e_2$$

$$\bar r_{P/O} = x\hat e_1 + y\hat e_2$$
$$= x'\hat b_1 + y'\hat b_2$$
$$= x'(c\theta\hat e_1 + s\theta\hat e_2) + y'(-s\theta\hat e_1 + c\theta\hat e_2) = \dots$$



$$B = (O, \hat{b}_1, \hat{b}_2, \hat{b}_3) \quad \text{polar}$$
$$= (O, \hat{e}_r, \hat{e}_\theta, \hat{e}_3) \quad \text{polar}$$

$$\bar{r}_{P/O} = r\hat{b}_1 \xrightarrow{\frac{{}^I d}{dt}} {}^I\bar{v}_{P/O} = \dot{r}\hat{b}_1 + r\dot{\theta}\hat{b}_2$$

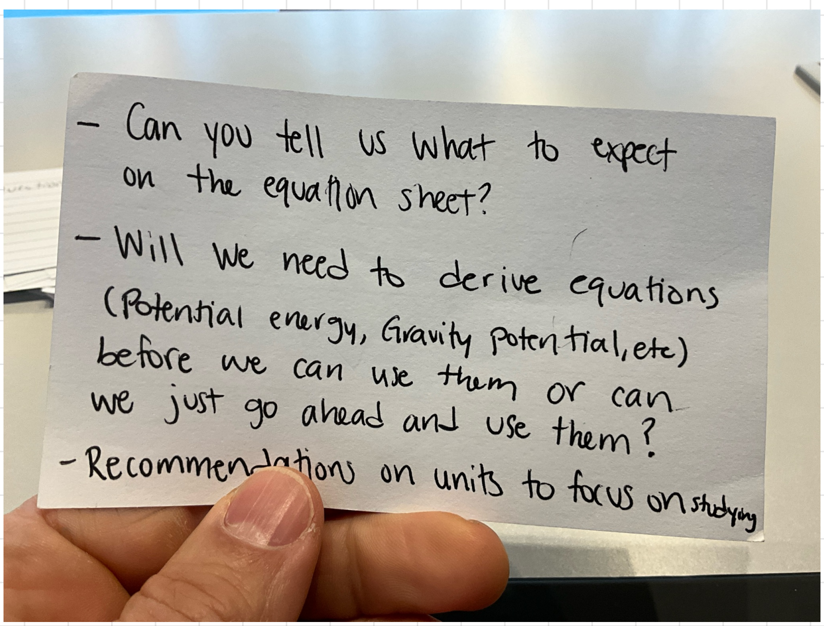


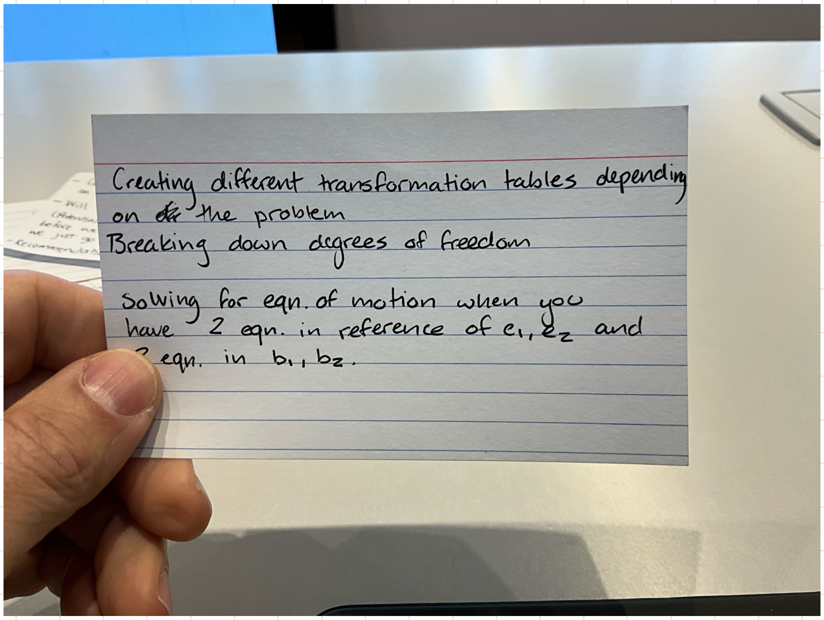
$$\bar{r}_{P/O} = x\hat{e}_1 + y\hat{e}_2$$
$$= r c\theta\, \hat{e}_1 + r s\theta\, \hat{e}_2$$

$$\frac{{}^I d}{dt}(\hat{b}_1) = {}^I\bar{\omega}^B \times \hat{b}_1$$

$= 0$ rotated

$\neq 0$ rotating





Creating different transformation tables depending on ~~the~~ the problem
Breaking down degrees of freedom

Solving for eqn. of motion when you have 2 eqn. in reference of e_1, e_2 and 2 eqn. in b_1, b_2.

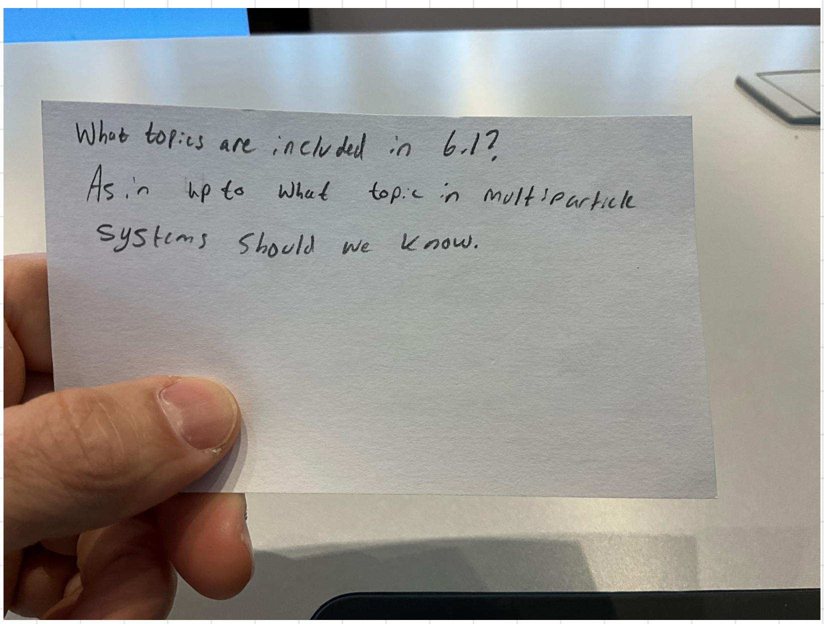
$$M = 3N - K$$

#particles

#constraints

$$F_p = mg\hat{e}_1 - T\hat{b}_1 = m_p\,{}^{I}\bar{a}_{p/o}$$

$$\hat{e}_1 : \quad mg - T\hat{b}_1 \cdot \hat{e}_1 = m_p\,{}^{I}\bar{a}_{p/o} \cdot \hat{e}_1$$



What topics are included in 6.1?
As in up to what topic in multiparticle systems should we know.

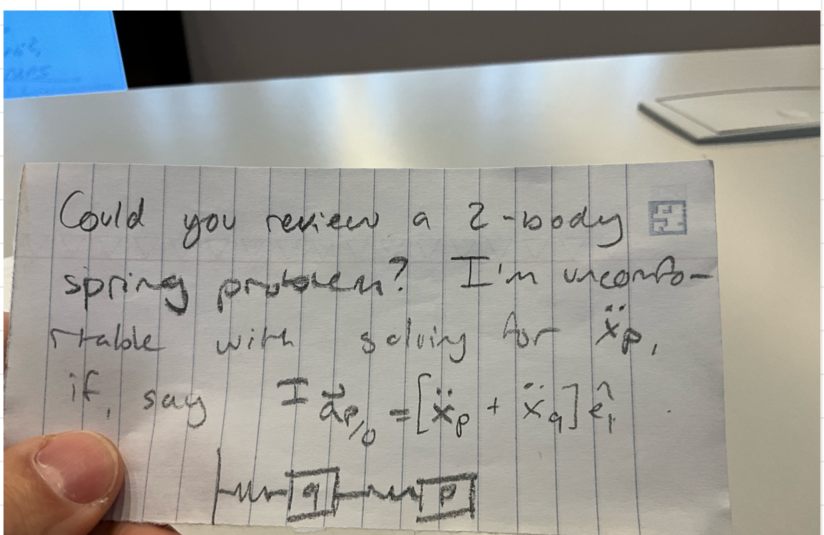
MPS

6.1 Linear momentum

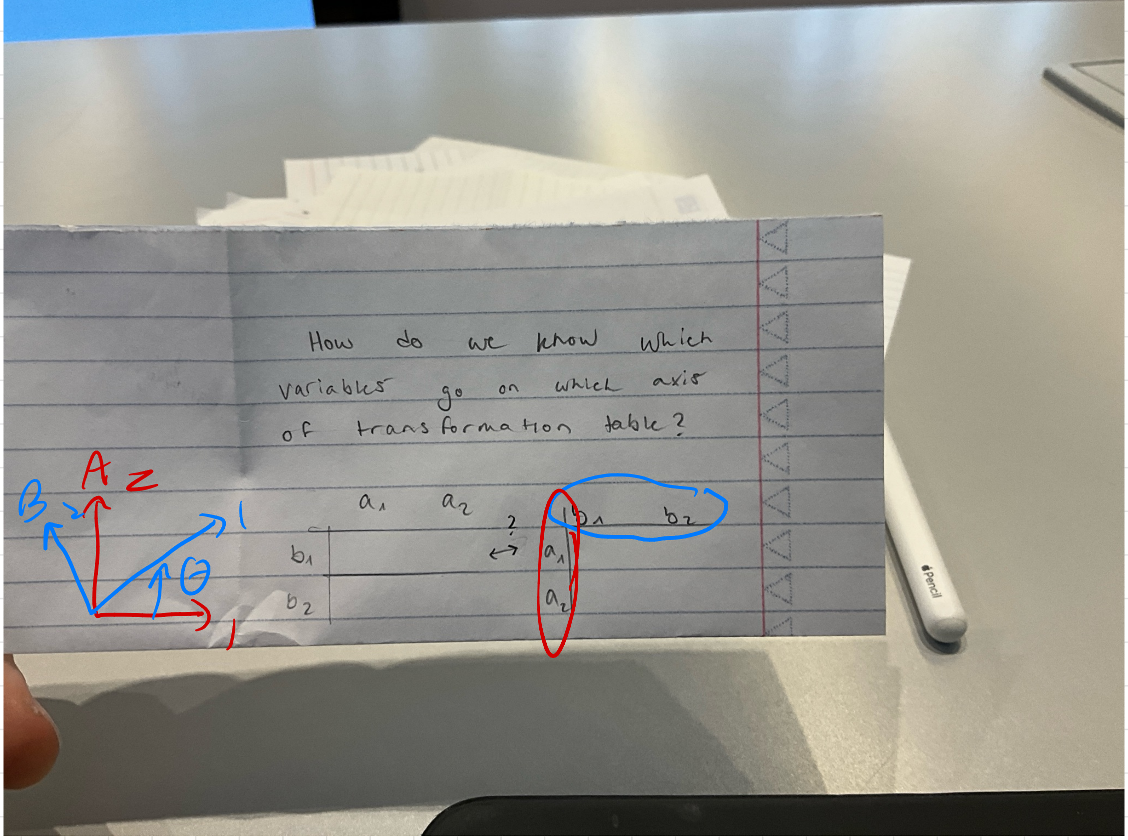
~~6.2. Impacts~~

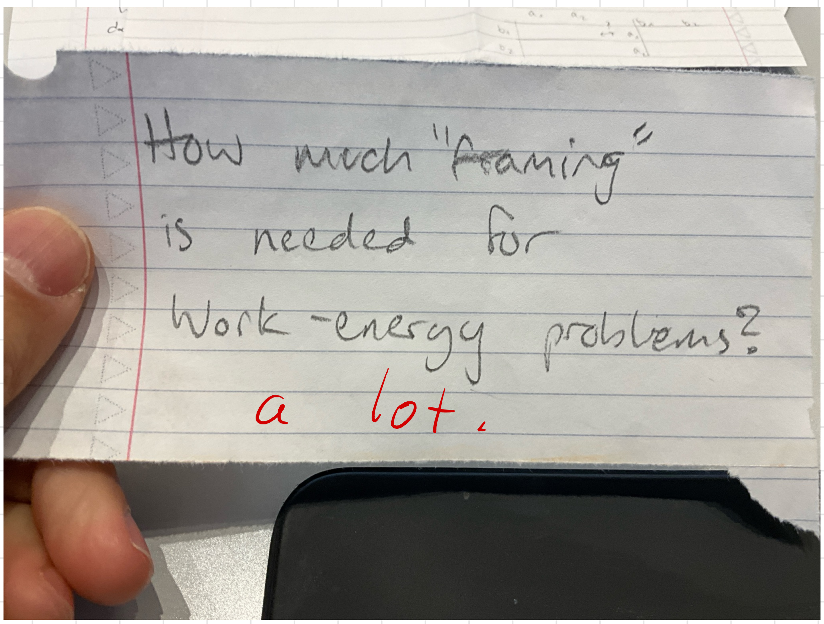
~~6.3. Variable Mass~~

→ Angular Moment@, Energy



Could you review a 2-body spring problem? I'm uncomfortable with solving for $\ddot{x}_p$, if, say ${}^{I}\vec{a}_{p/o} = [\ddot{x}_p + \ddot{x}_q]\hat{e}_1$





$$W_p = \int_{\gamma_p} \boxed{\bar{F}_p \cdot \bar{v}_{p/o}}\, dt$$

=0 normal forces