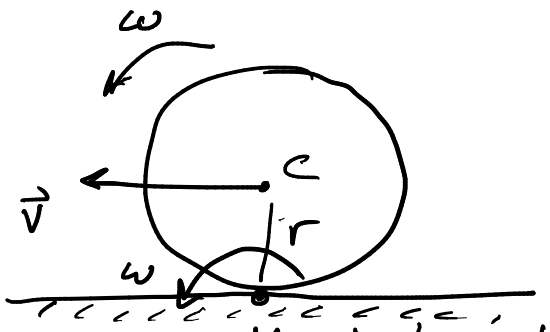
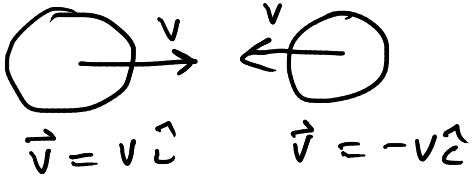
Sign conventions

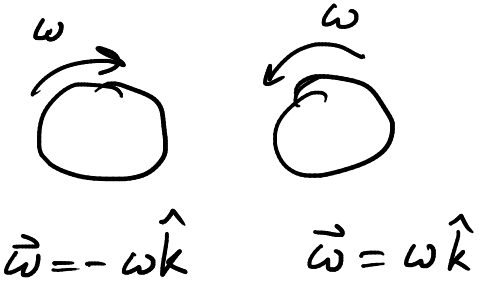
Rolling motion:

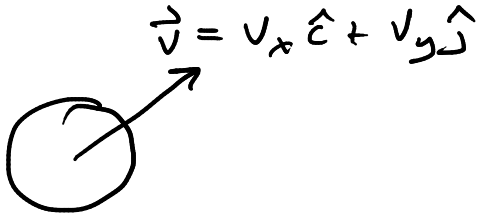


$$V = \omega r$$



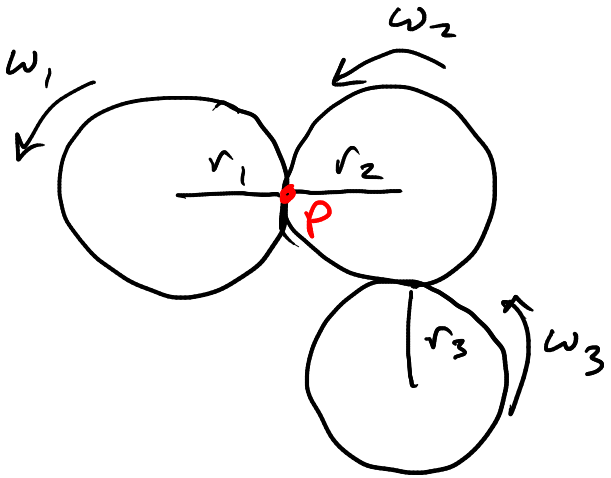
	$\vec{v} = v\hat{\imath}$	$\vec{v} = -v\hat{\imath}$
$\vec{\omega} = \omega\hat{k}$	A	B
$\vec{\omega} = -\omega\hat{k}$	C	D



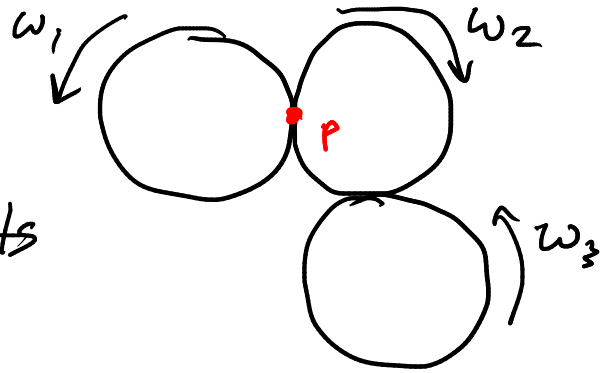


gears

establish sign conventions



	A	B
$\vec{\omega}_1 = +\omega_1\hat{k}$	+	−
$\vec{\omega}_2 = +\omega_2\hat{k}$		
$\vec{\omega}_3 = +\omega_3\hat{k}$		



~~$\omega_1 = 4$ rad/s~~

$\vec{\omega}_1 = \omega_1 \hat{k}$

$\vec{\omega}_2 = -\omega_2 \hat{k}$

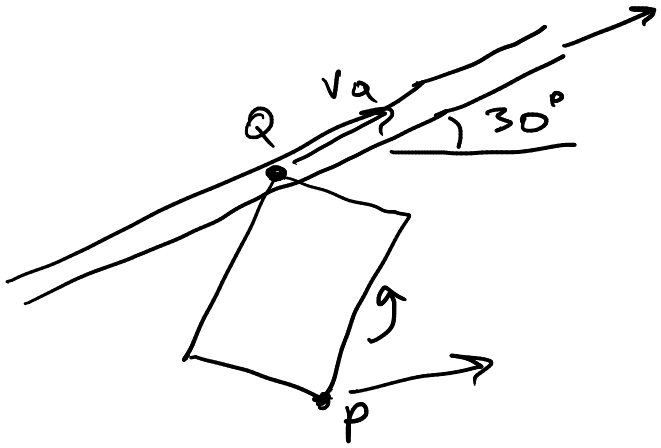
$\vec{\omega}_3 = \omega_3 \hat{k}$

A: ↑ point P

B: ↓

C: ?

Constrained motion



$\hat{e}_t = \cos 30^\circ \hat{i} + \sin 30^\circ \hat{j}$

$= \frac{\sqrt{3}}{2}\hat{i} + \frac{1}{2}\hat{j}$

$\vec{v}_P = 4\hat{i} + v_{Py}\hat{j}$

$\vec{\omega} = 2\hat{k}$

what is $\vec{v}_Q$?

$\vec{r}_{PQ} = -\hat{i} + 6\hat{j}$

choose $\vec{v}_Q = v_Q \hat{e}_t$

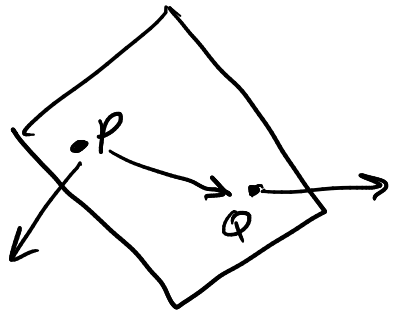
$\vec{v}_Q = \vec{v}_P + \vec{\omega} \times \vec{r}_{PQ}$

topics on midterm 2:

- velocity and acceleration of rigid bodies
- constrained motion for rigid bodies
- instantaneous center
- gears and chains
- multiple rigid bodies ($\vec{v}$, $\vec{a}$)
- rolling on flat surfaces
- rolling on curved surfaces.

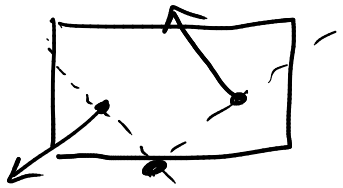
instantaneous centers:

- algebraic: $\vec{v}_M = 0 = \vec{v}_P + \vec{\omega} \times \vec{r}_{PM} \Rightarrow \vec{r}_{PM} = \frac{\perp}{\omega^2} \vec{\omega} \times \vec{v}_P$

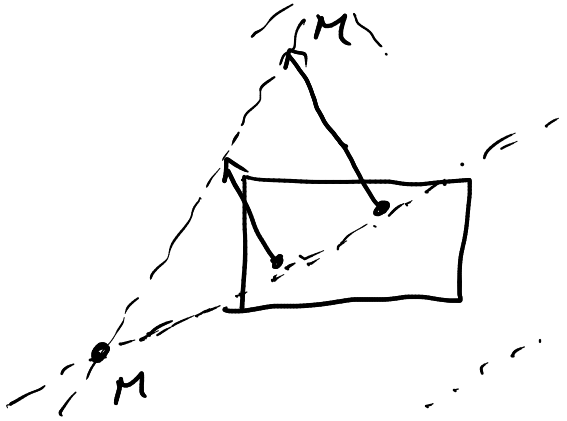


$\Rightarrow \vec{\omega} \Rightarrow M$

- geometric:

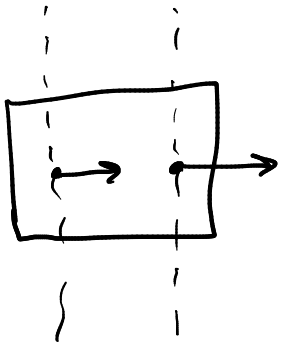


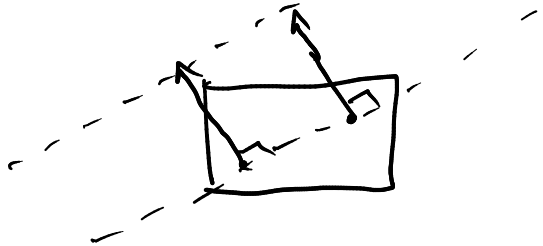
unique intersection of perpendiculars.



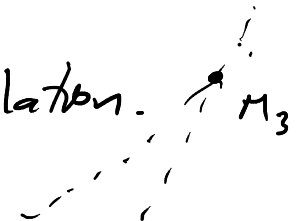
repeated line add line through velocity ends.

no M
pure trans.





no M
pure translation.



real M?

A : M_1

B : M_2

C : M_3

D : none / impossible situation.