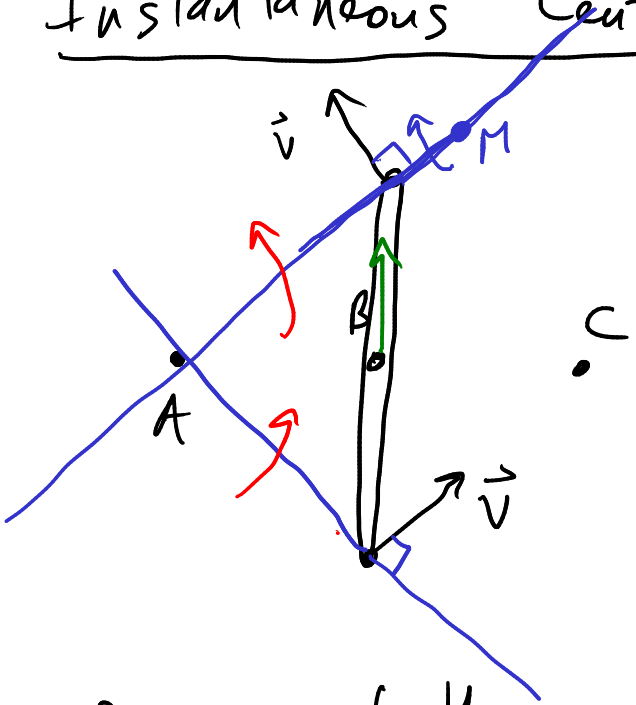
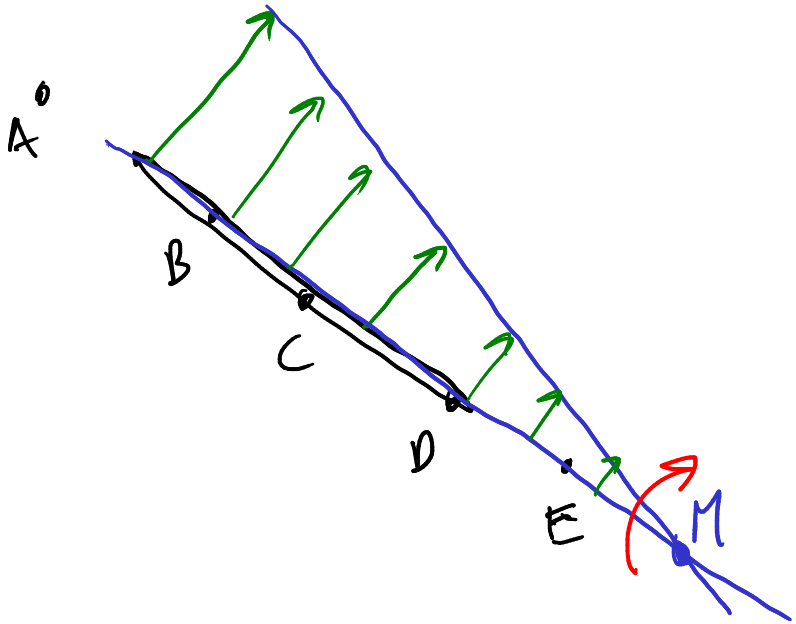
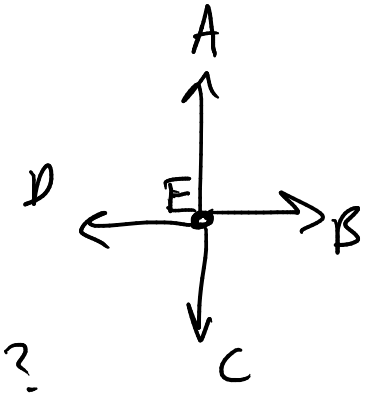
Instantaneous Centers

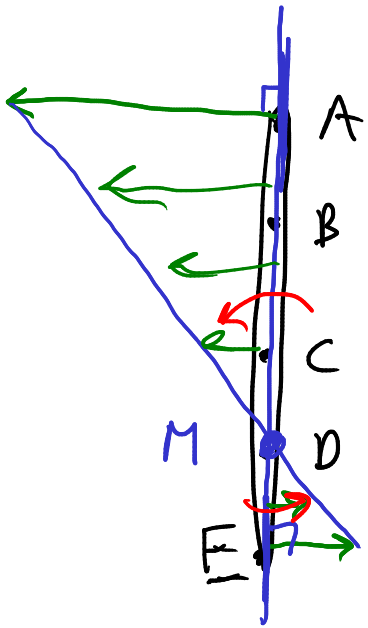


D = none of the above

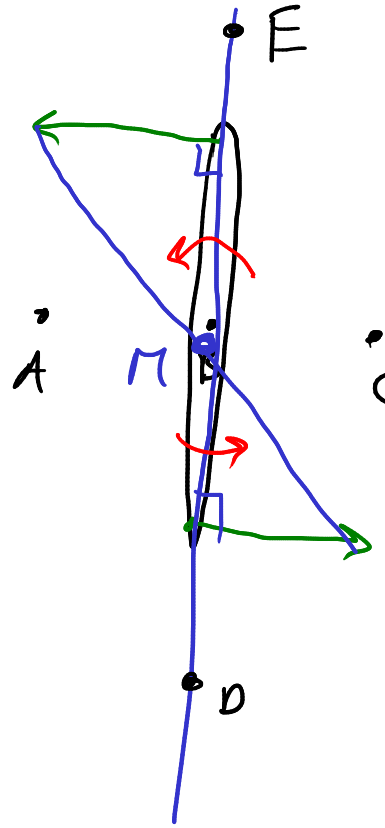


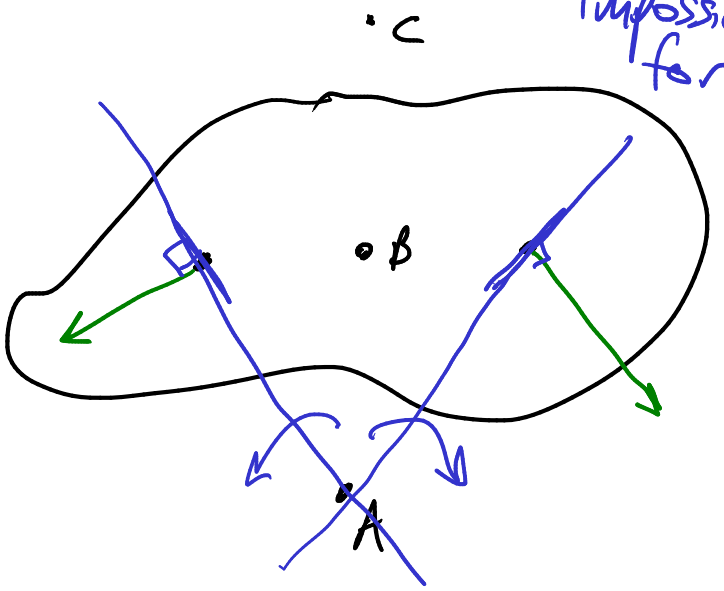


$\vec{V}_B$?



$V = \omega r$



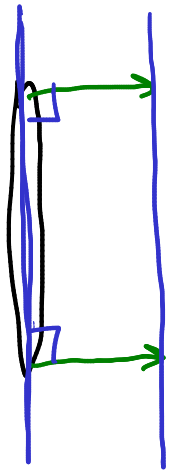


impossible for rigid body.

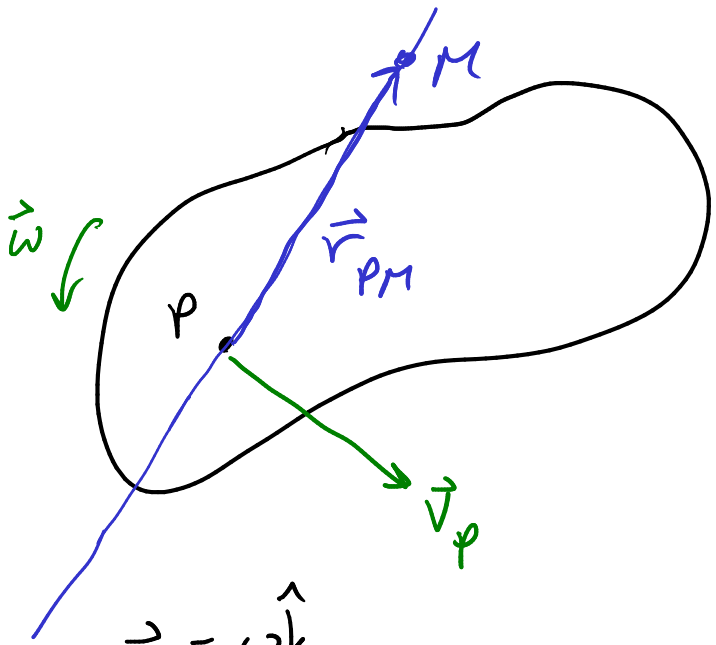
① intersect the perpendiculars ⇒ just one point : M

if multiple points:

② join tips, intersect with perpendicular : M.



⇒ no rotation.



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

$v_P = r_{PM}\,\omega$

$\vec{v}_M = \vec{v}_P + \vec{\omega} \times \vec{r}_{PM}$

0 ← inst. center is not moving

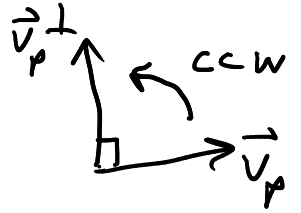
$0 = \vec{v}_P + \vec{\omega} \times \vec{r}_{PM}$ ← 2D

$\vec{\omega} \times \vec{0} = \vec{\omega} \times \vec{v}_P + \vec{\omega} \times (\vec{\omega} \times \vec{r}_{PM})$

$0 = \vec{\omega} \times \vec{v}_P - \omega^2 \vec{r}_{PM}$

$$\boxed{\vec{r}_{PM} = \frac{1}{\omega^2}\,\vec{\omega} \times \vec{v}_P}$$

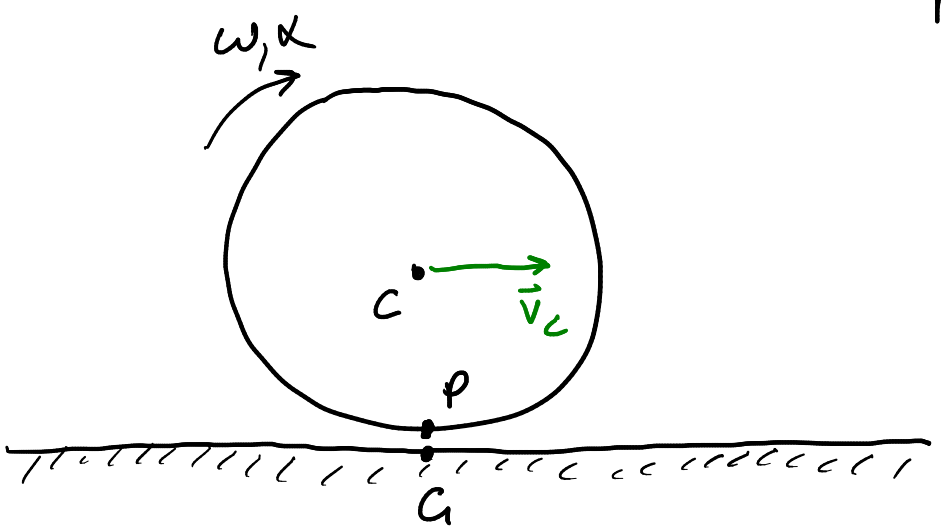
$\vec{\omega} \times \vec{v}_P = \omega \vec{v}_P^{\perp}$



$$\boxed{\vec{r}_{PM} = \frac{1}{\omega}\,\vec{v}_P^{\perp}}$$

$$\boxed{r_{PM} = \frac{v_P}{\omega}}$$

Rolling motion



rolling versus sliding

→ $\vec{v}_P = \vec{v}_G$

rolling ⇒ no slip

⇒ no relative velocity for points in contact

⇒ points in contact have same $\vec{v}$