TAM 212 Class 24

Instantaneous Center
RB's in Contact

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* Midterm 2 : April 9th

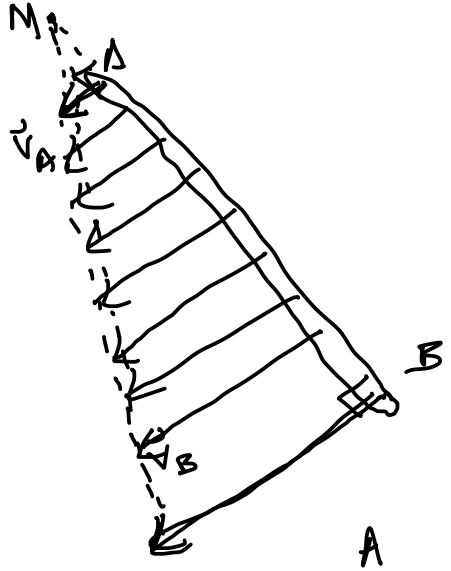
Final Exam : W May 13th 1:30-4:30

Review: Instantaneous Center of Velocity (IC) : the point that the RB is rotating about at that instant

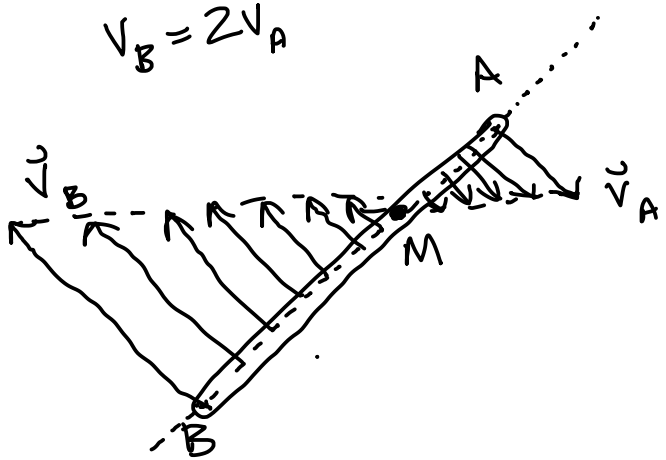
(1) The I.C. can be on or off the R.B. itself

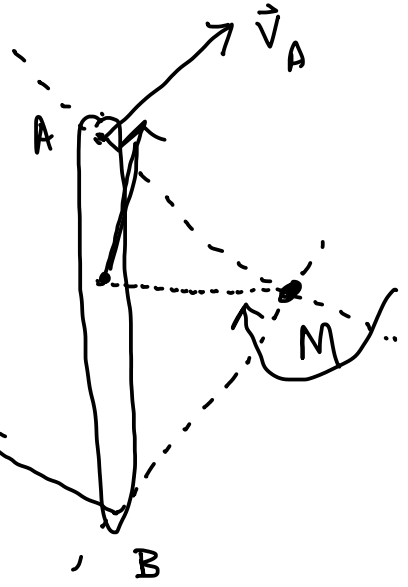
(2) The I.C. can change during the motion (not nec. constant)

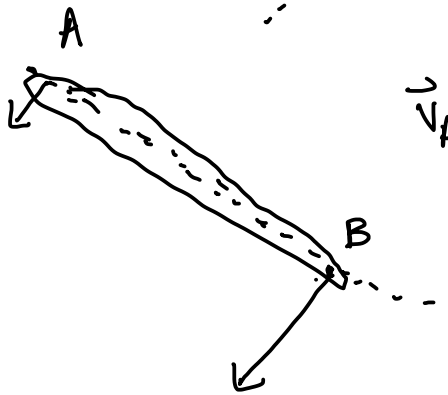
Ex)



$V_B = 2V_A$

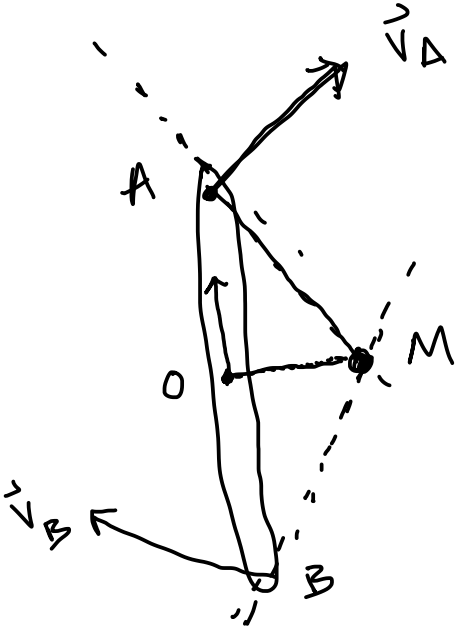






$\vec{V}_A = \vec{\omega} \times \vec{r}_{MA} \Rightarrow$ mag. ωr_{MA}

$\vec{V}_B = \vec{\omega} \times \vec{r}_{MB} \Rightarrow$ mag ωr_{MB}

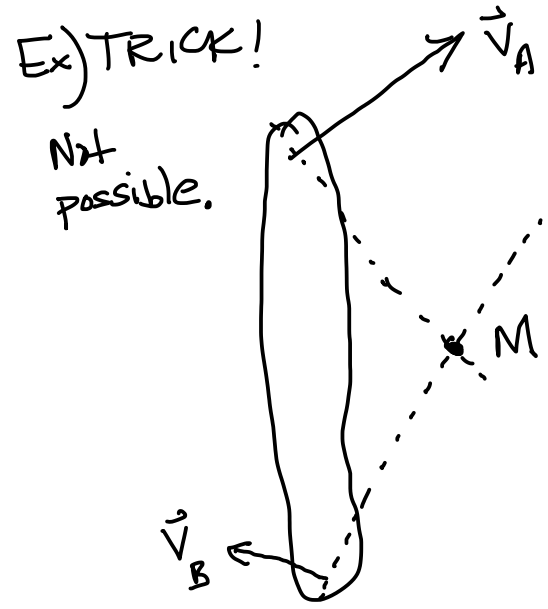


$$\vec{V}_A = \vec{\omega} \times \vec{r}_{MA}$$

$$\boxed{\vec{V}_B = \vec{\omega} \times \vec{r}_{MB}}$$

$$\vec{V}_O = \vec{\omega} \times \vec{r}_{MO}$$

Ex) TRICK!

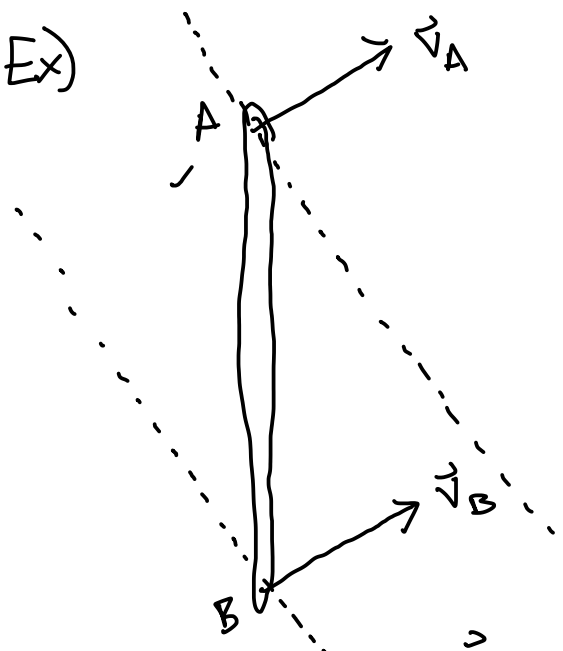


Mathematically if we try to find $\vec{\omega}$:

$$\vec{V}_A = \vec{\omega} \times \vec{r}_{MA}$$

$$\vec{V}_B = \vec{\omega} \times \vec{r}_{MB}$$

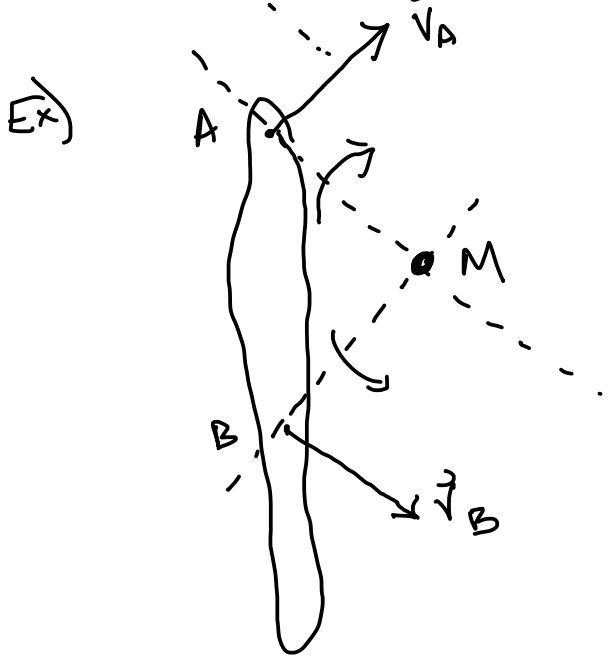
Ex)



$\vec{v}_A = \vec{v}_B$

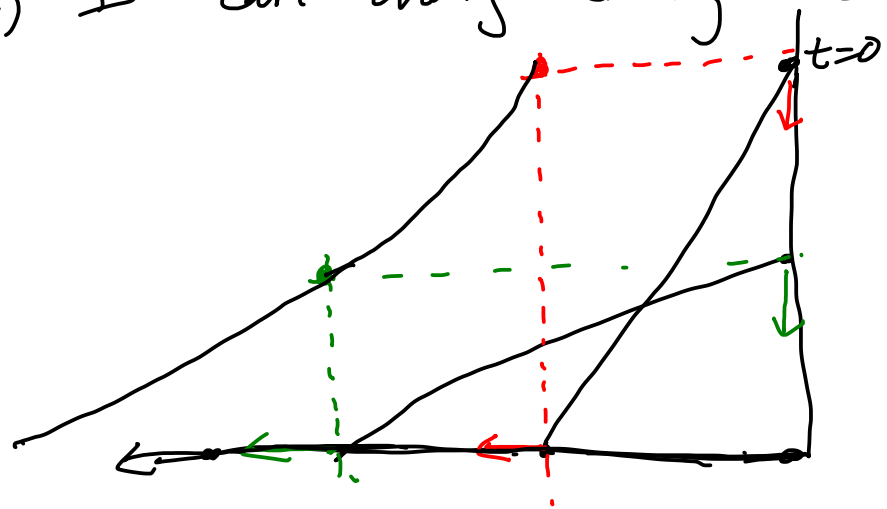
$\vec{\omega} = 0\,\hat{k}$ rad/sec pure translation

Ex)



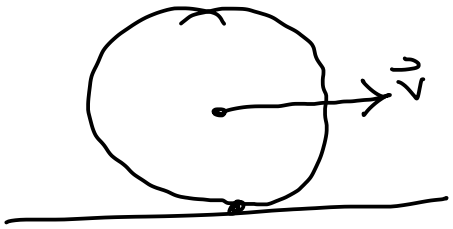
Not possible.

Ex) IC can change during RB motion

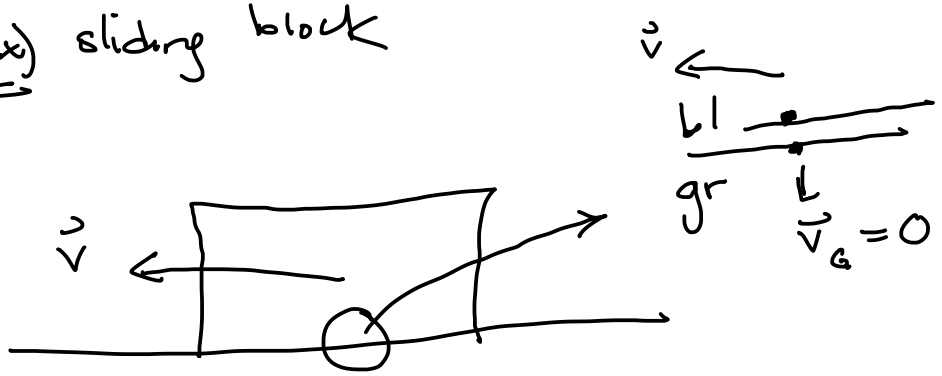


Rigid Bodies in Contact

ex) rolling wheel



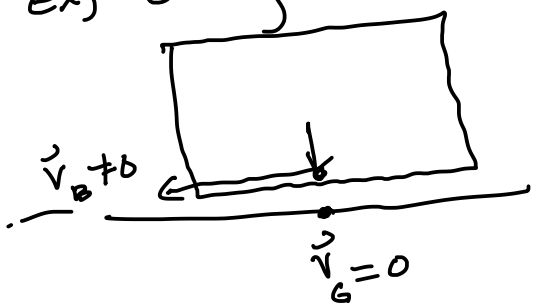
ex) sliding block



Generally two types of contact are possible

(A) slipping : the velocity of any two points in contact are different from each other

ex) sliding block



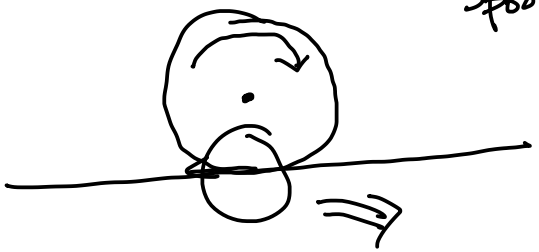
Notice how the components of $\vec{v}$ ↑

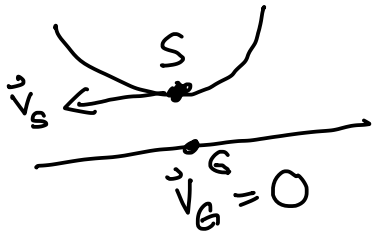
(A) normal to the path = 0 for both $\vec{v}_G, \vec{v}_B$

(B) tangential components can differ

another example of slipping:

spools spins on the ground, no forward progress





(1) iclicker: the normal component of the acceleration vector at point S is the same as at point G

A) TRUE

B) FALSE