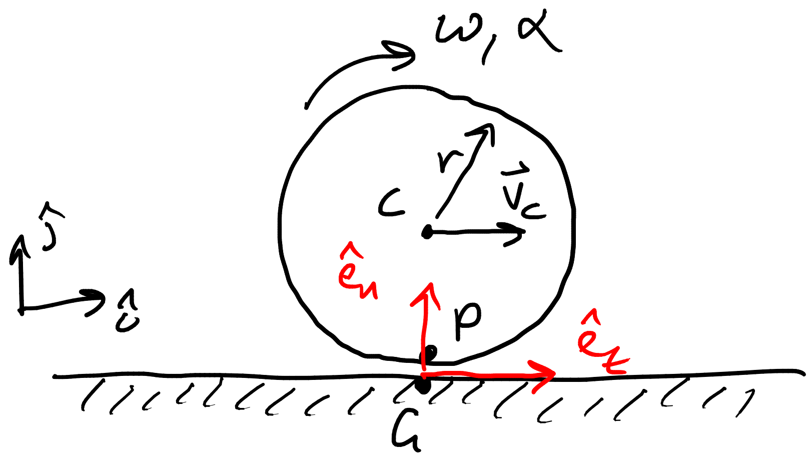
Rolling motion



$$\boxed{\vec{v}_Q = \vec{v}_p + \vec{\omega} \times \vec{r}_{pQ}}$$

$$\vec{v}_c = \cancel{\vec{v}_p}^{\,0} + \vec{\omega} \times \vec{r}_{pc}$$

$$v_c \hat{e}_t = -\omega \hat{k} \times (r \hat{e}_n)$$

$$= r\omega\, \hat{e}_t$$

$$\boxed{v_c = r\omega}$$

$$\boxed{v_p = 0}$$

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

$$\vec{\alpha} = -\alpha \hat{k}$$

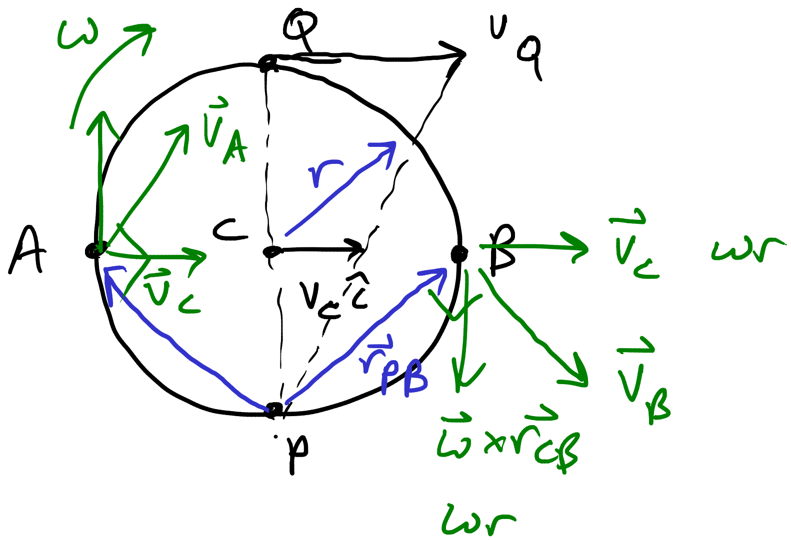
rolling vs skidding

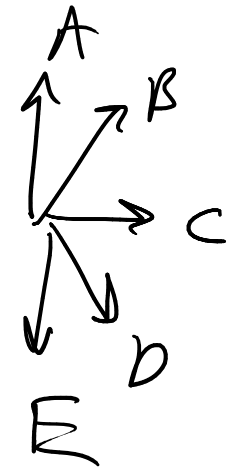
= relative motion of P & G.

rolling $\Rightarrow$ no slip between P & G

$\Rightarrow \vec{v}_p = \vec{v}_G = 0$

$\Longrightarrow$ points of contact have zero relative velocity.





$\vec{v}_Q$?

$\vec{v}_B$? $= \vec{v}_c + \vec{\omega} \times \vec{r}_{cB}$

$= \vec{\omega} \times \vec{r}_{pB}$

$\vec{v}_A$?

$$\vec{v}_Q = \vec{v}_c + \vec{\omega} \times \vec{r}_{cQ}$$

$$\vec{v}_Q = \underbrace{\cancel{\vec{v}_p}}_{0} + \vec{\omega} \times \vec{r}_{pQ}$$