## ROTATIONAL DYNAMICS OF ROLLING MOTION

● In some problems, a disc-like object accelerates around a FREE axis**.**

   - In these, the object will have both rotational AND linear motion**.**

   - So we use _____ AND _____ for the SAME object**!**

   - The direction of positive in BOTH will follow the direction of _____**.**

● Remember**:** <u>Rolling Motion</u> has an extra equation**:** $v_{,CM}$ **=** _____**.**

   - When disc-like objects roll freely, Torque comes from _____**.**

      - If $\alpha \neq 0$ → there is _____**.**

      - If "without slipping" → there is _____**.**
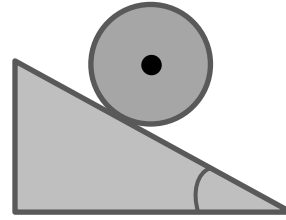
<u>EXAMPLE</u>**:** When a solid cylinder of mass M and radius R is released from rest, it rolls down without slipping along an inclined plane that makes an angle Θ with the horizontal. Derive an expression for the angular acceleration of the cylinder**.**

PRACTICE: ROTATIONAL DYNAMICS / SPHERE GOING UP HILL

PRACTICE: A hollow sphere 10 kg in mass and 2 m in radius rolls without slipping along a horizontal surface with 20 m/s. It then reaches an inclined plane that makes 37° with the horizontal, as shown. If it rolls up the incline without slipping, how long will it take to reach its maximum height? (Hint: You will need to first calculate its acceleration)