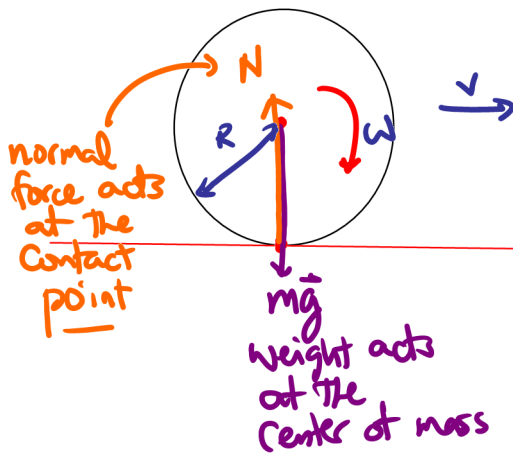


# BALL ROLLING ON A FLAT SURFACE WITHOUT SLIPPING



- rolls without slipping
- neither the ball nor the flat surface deforms (rigid body)

1. no friction at all
2. neither  $\vec{N}$  nor  $m\vec{g}$  generate any torque.
3. neither  $\vec{N}$  nor  $m\vec{g}$  generate any force along the direction of motion.

$$v = \omega R$$

This relationship holds when there is no slipping.

$$F_{\text{net}} = 0, \tau_{\text{net}} = 0$$

The ball will roll on this flat surface with constant velocity forever.

"rolling resistance"

There is both a net force and net torque the ball rolls slower in time.

(There may or may not be friction)

depends on how the contact surface deforms.

## IN REAL LIFE

