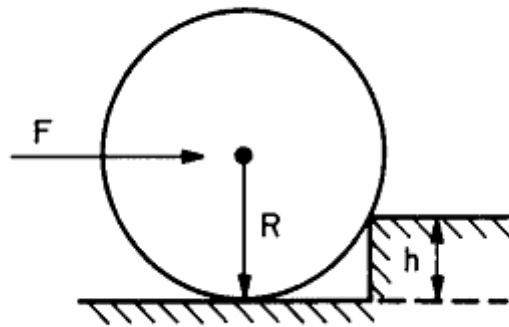
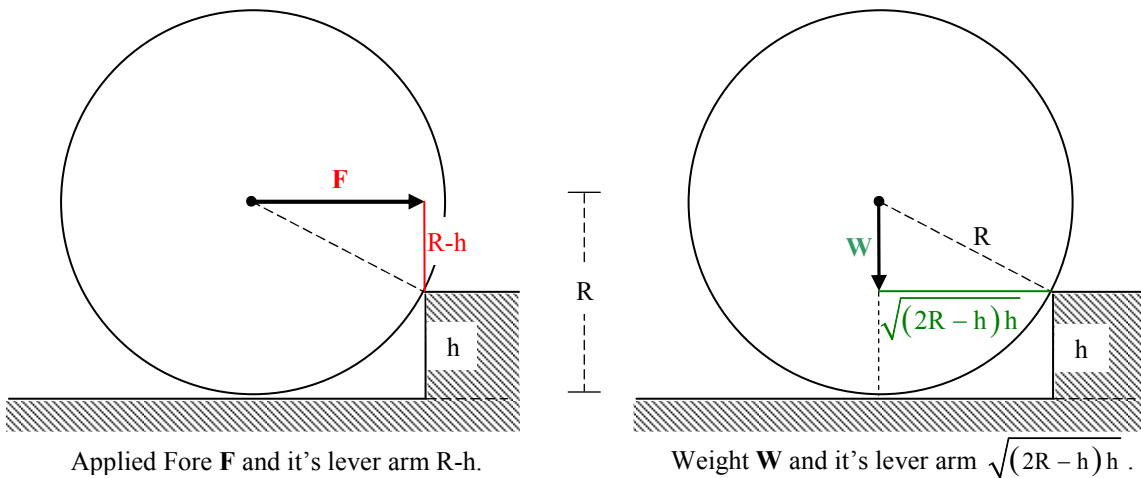


## wheel and block



What horizontal force  $F$  (applied at the axle) is required to push a wheel of weight  $W$  and radius  $R$  over a block of height  $h$ ?

### Valentin Eberhardt's Solution (using torque)



The wheel will start rotating about the point of contact with the block when the torque from the applied force  $F$  about that point exceeds the torque from the wheel's weight  $W$ . Torque equals the magnitude of the force times the length of its *lever arm* (see diagrams). Thus

$$F(R-h) = W\sqrt{(2R-h)h},$$

from which it follows directly that

$$F = W\sqrt{(2R-h)h}/(R-h).$$