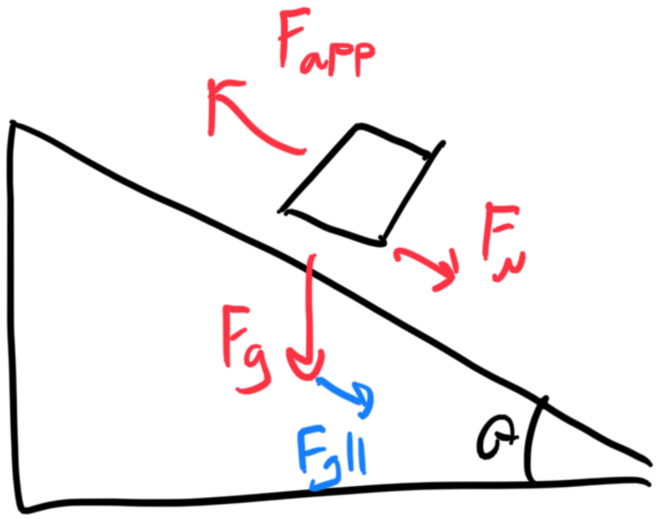
2018 A #6



$$F_{\parallel_{net}} = F_{app} - F_N - F_g \sin\theta$$

... kinematics

$$\Delta K = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$ ($v_i = 0$)

$$\Rightarrow \boxed{v = \sqrt{\frac{2K}{m}} = 4.24\ m/s}$$

$$W = (F_{app} - F_N)\, l = 3000\ J$$

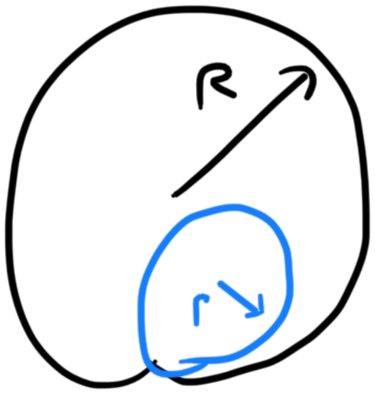
$$\Delta U_g = mgh = mgl\sin\theta = 1967\ J$$

$$\Delta K = W - \Delta U_g = 1033\ J$$

$$\vec{F}_{net} = \vec{F}_{app} + \vec{F}_N + \vec{F}_g + \vec{F}_N$$

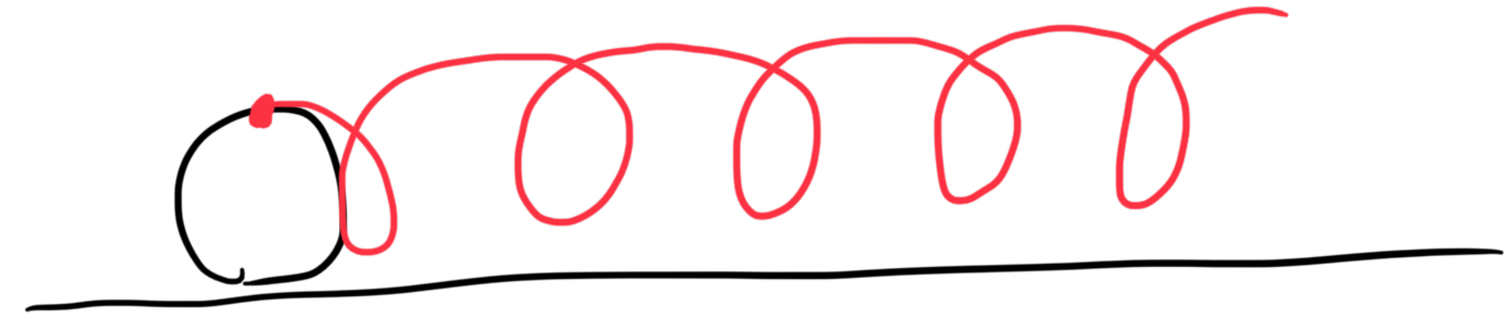
$$F_{net_\parallel} = F_{app} - F_N - F_{g_\parallel} \sin\theta$$

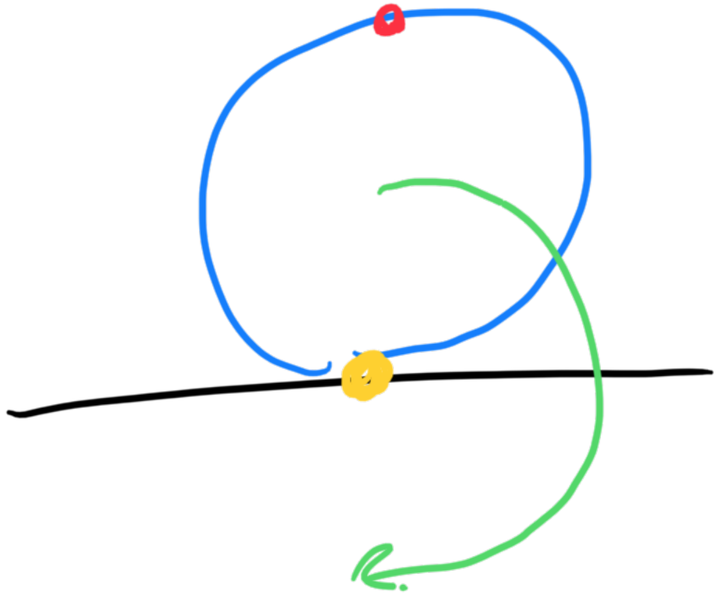
2018A #8



$$\omega_{center} = \frac{2\pi}{T}$$

$$v_{center} = \frac{2\pi}{T}(R-r)$$





$$v_{center} = \frac{2\pi}{T}(R-r)$$

$$\omega_{center} = \frac{2\pi}{T}\frac{(R-r)}{r}$$

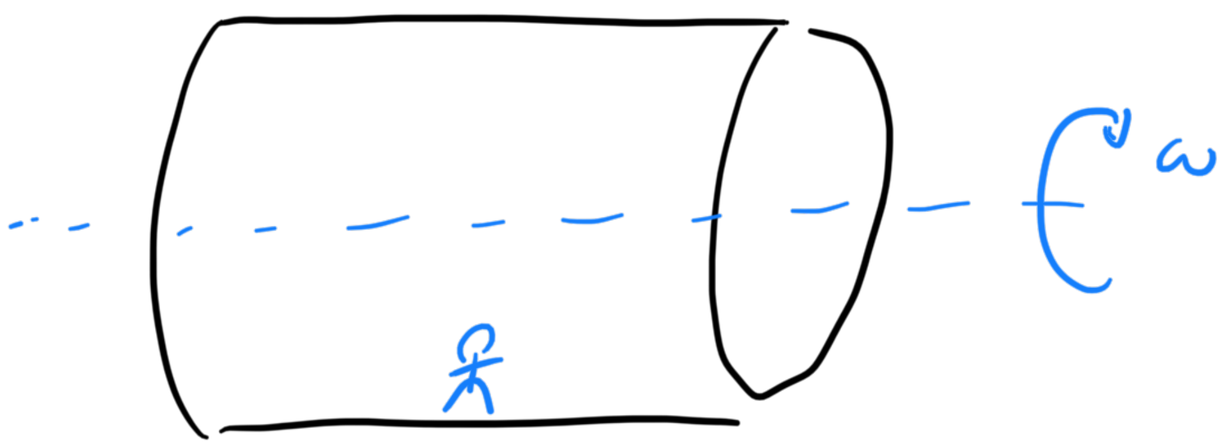
$$v_{edge} = r_{edge}\,\omega_{center}$$

$$= 2r\,\frac{2\pi}{T}\,\frac{(R-r)}{r}$$

$$= \frac{4\pi}{T}(R-r)$$

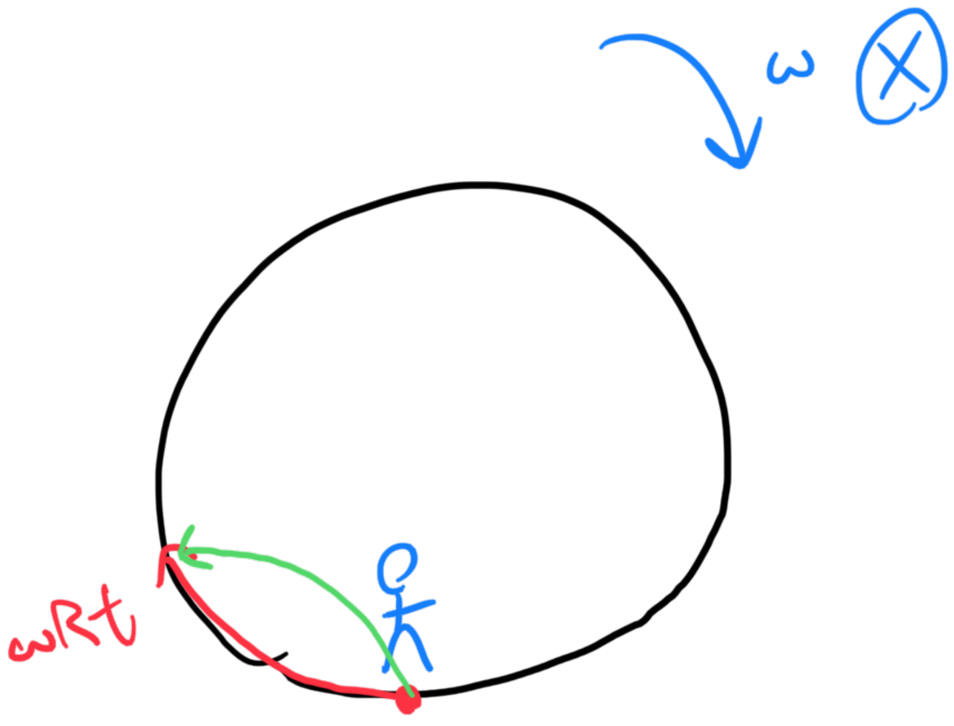
(D)

#16



A B C ~~D~~ ~~E~~

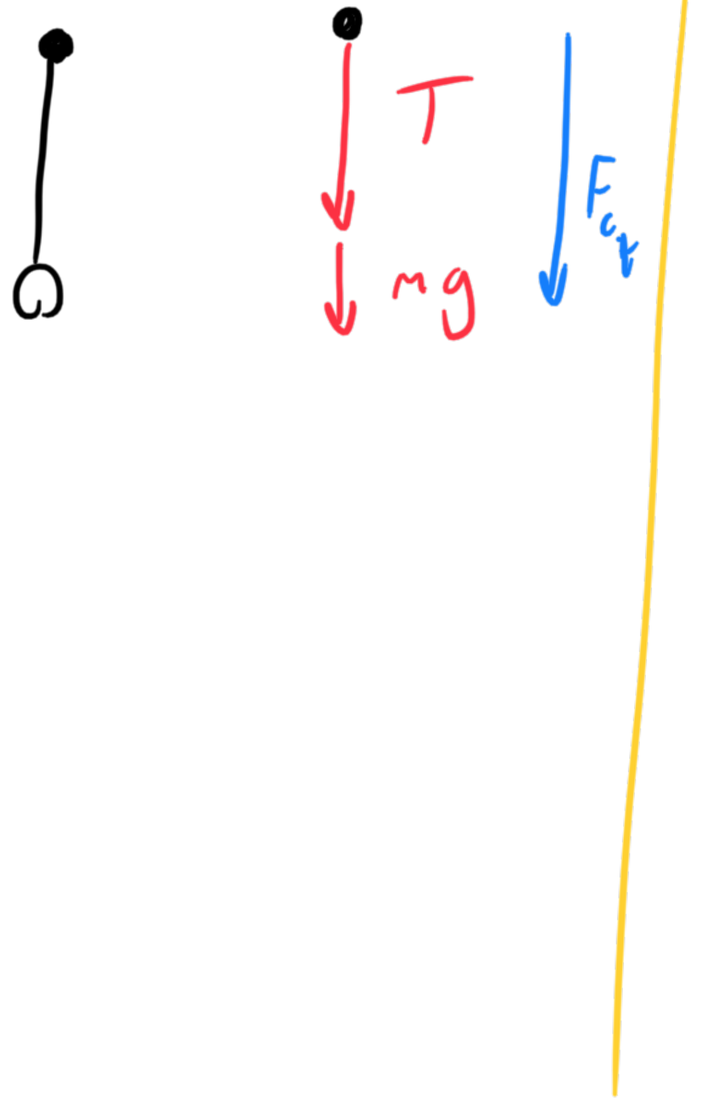
Centrifugal force: radially outward!

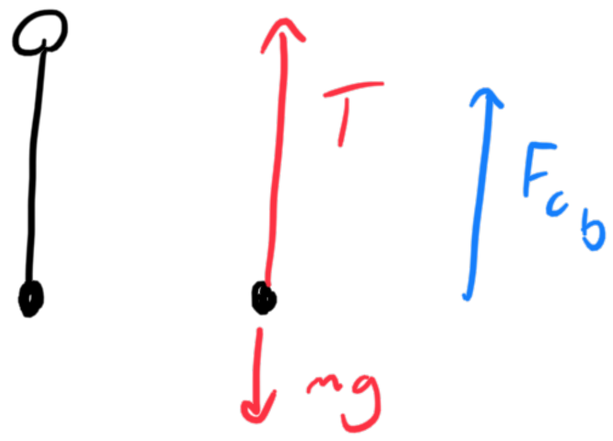


$$F_c = -2m\vec{\omega}\times\vec{v}$$

2018A #18

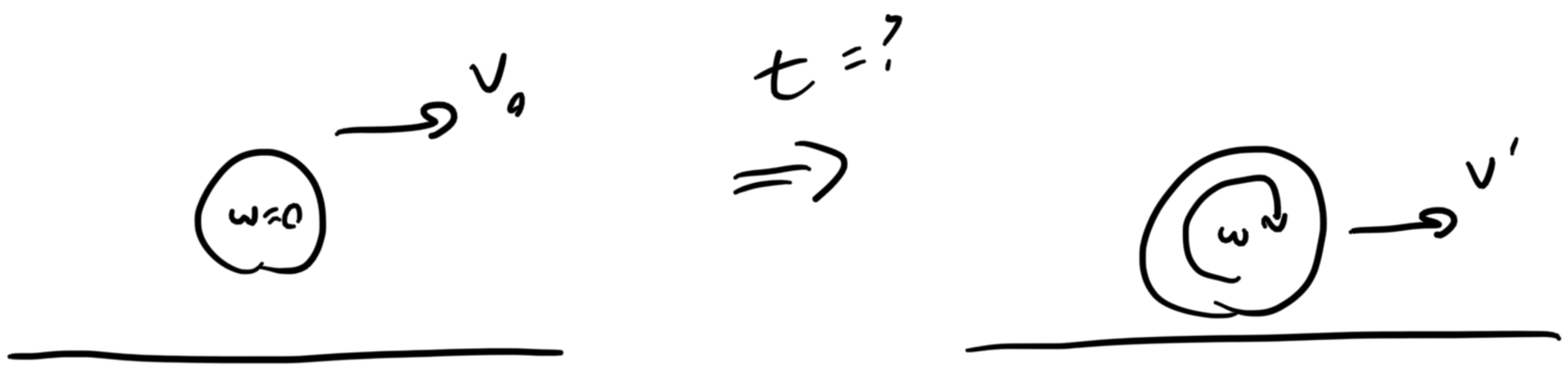
$$\Delta F_c = m\Delta a_c = \frac{\Delta(mv^2)}{\ell} = \frac{2\Delta K}{\ell} = \frac{4mg\ell}{\ell} = 4mg$$





$$\Delta T = 6mg$$

2018A #21



rolling w/o slipping

$F_N = -\mu mg$

$a = -\mu g$

$I = \frac{2}{3}mr^2$

$\tau = I\alpha \Rightarrow \quad \alpha = \frac{\mu mgr}{\frac{2}{3}mr^2} = \frac{3}{2}\mu g/r$

$v' = \omega' r$

$= \alpha r t$

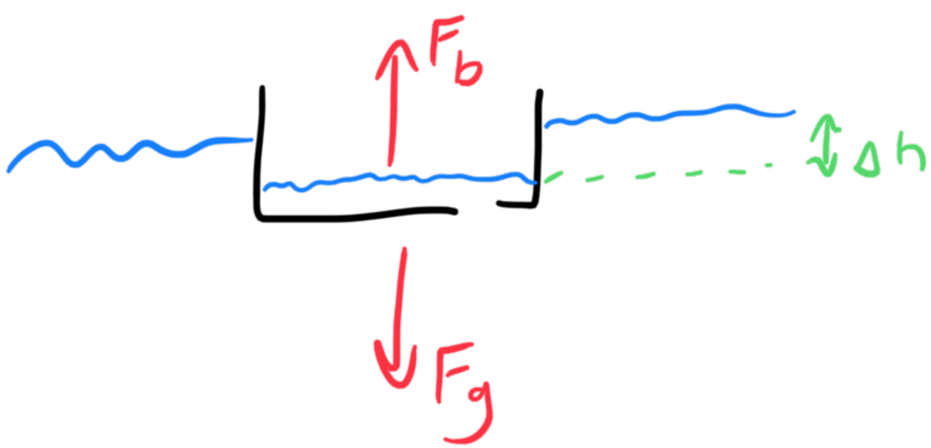
$v' = v_0 - \mu g t$

$\alpha = \frac{3}{2}\mu g t/r$

$v_0 - \mu g t = \frac{3}{2}\mu g t$

$t = \frac{2}{5} v_0/\mu g$ (A)

2018A #22



$F_b \propto \Delta h$