/

$\omega_i = 18$ rad/s

$\alpha = -1.9$ rad/s^2

$\omega_f = 0$

want $\Delta\theta$

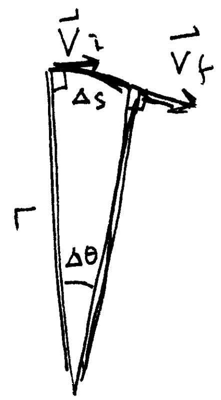
$0^2 = 18^2 + 2(-1.9)\Delta\theta$

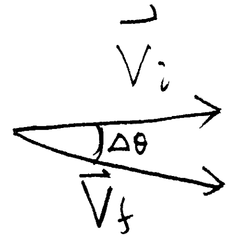
$\Delta\theta = \frac{18^2}{2(1.9)} = 85.26$ rad.

$= \Delta s$ (no slipping)

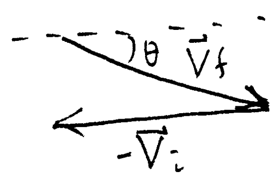
Distance travelled $= r\Delta\theta$

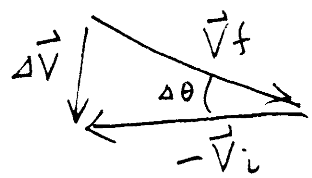
$= \frac{0.024}{2}(85.26) = 1.02$m





$$\Delta \vec{V} = \vec{V}_f - \vec{V}_i$$
$$= \vec{V}_f + (-\vec{V}_i)$$





(similar triangles, all angles the same)

$$\frac{\Delta s}{r} = \frac{\Delta V}{V}$$

Definition of tangential velocity $V = \frac{\Delta s}{\Delta t} \Rightarrow \Delta s = V \Delta t$

$$\frac{V \Delta t}{r} = \frac{\Delta V}{V}$$

$$\frac{\Delta V}{\Delta t} = \frac{V^2}{r}$$

$$\boxed{a_c = \frac{V^2}{r}} \quad a_c = \frac{(\omega r)^2}{r} = \omega^2 r$$

Bank curves

At the appropriate velocity, car can make the turn even without friction

$$F = ma$$

vertical : $n\cos\theta - mg = m(0)$ ①

horizontal : $n\sin\theta = m a_c$ ②

$$= m\frac{v^2}{r}$$

From ① $n = \dfrac{mg}{\cos\theta}$

substitute in ② $\left(\dfrac{mg}{\cos\theta}\right)\sin\theta = m\dfrac{v^2}{r}$

$$\tan\theta = \frac{v^2}{rg}$$