NYU Physics I — 2016-09-15.

Agenda — Exams — postponed

— scope

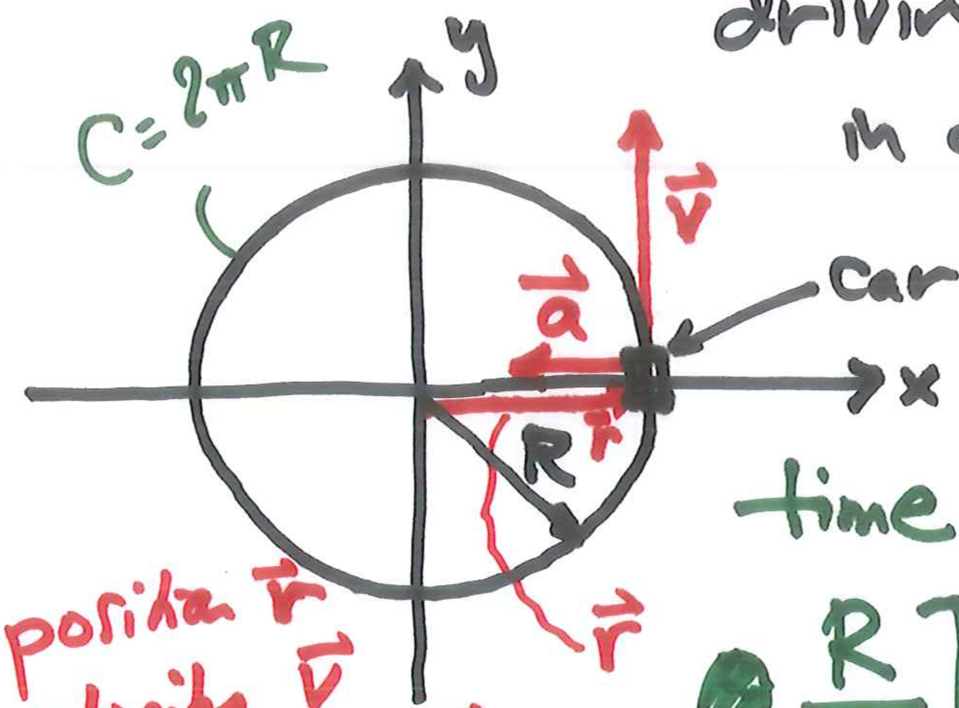
— Qs.

— Circular motion.

— Forces acting on a car.

— (Gaia)

driving @ constant speed v in a circle of radius R.



$v \equiv |\vec{v}|$

position $\vec{r}$
velocity $\vec{v}$
acceleration $\vec{a}$

time ?

acceleration ?

$\frac{R}{v}$

$\frac{v^2}{R}$

$\boxed{\frac{2\pi R}{v}}$ period

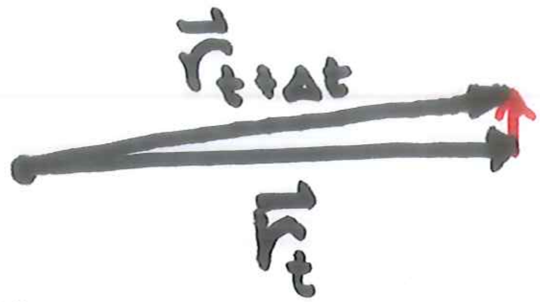
$\frac{7!\, R}{v}$

$\frac{v}{T}$ $T = \frac{R}{v} \to \frac{v^2}{R}$

$\frac{R}{T^2}$ $T = \frac{R}{v} \to \frac{v^2}{R}$

$\theta \equiv \frac{\ell}{r}$

$\frac{d\vec{r}}{dt} = \vec{v}$	$\frac{d\vec{v}}{dt} = \vec{a}$



$$\vec{\Delta r} = \vec{r}_{t+\Delta t} - \vec{r}_t$$

$$\vec{\Delta r} = \vec{V}\,\Delta t \leftarrow ①$$

$$\vec{V} \equiv \lim_{\Delta t \to 0} \left[\frac{\vec{r}_{t+\Delta t} - \vec{r}_t}{\Delta t} \right]$$

$$① \quad \vec{V} \equiv \lim_{\Delta t \to 0} \frac{\vec{\Delta r}}{\Delta t}$$

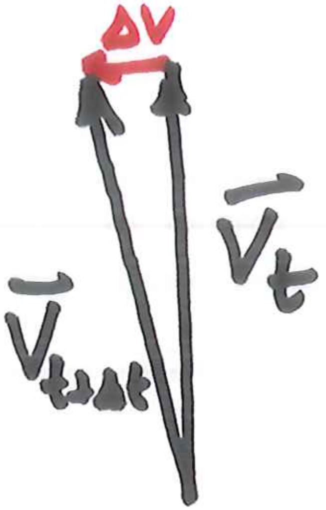
$$|\vec{\Delta r}| = |\vec{r}| \cdot \Delta\theta$$

$$\Delta\theta = \frac{2\pi}{T}\,\Delta t$$

$$\Delta\theta = \underbrace{\frac{V}{R}}\,\Delta t$$

angular frequency..

$$\frac{\text{radians}}{\text{second}} = \omega$$



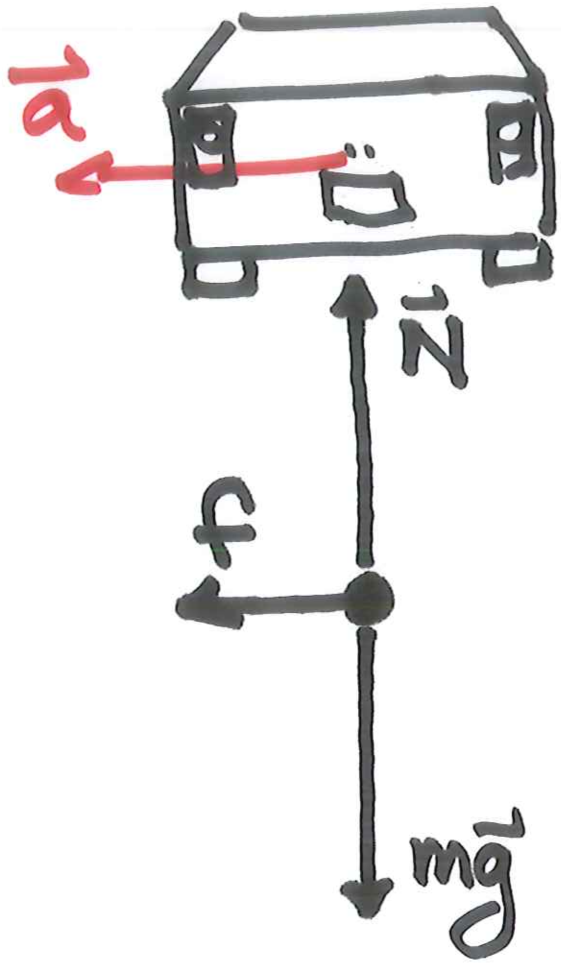
$$\vec{\Delta v} = \vec{a}\,\Delta t$$

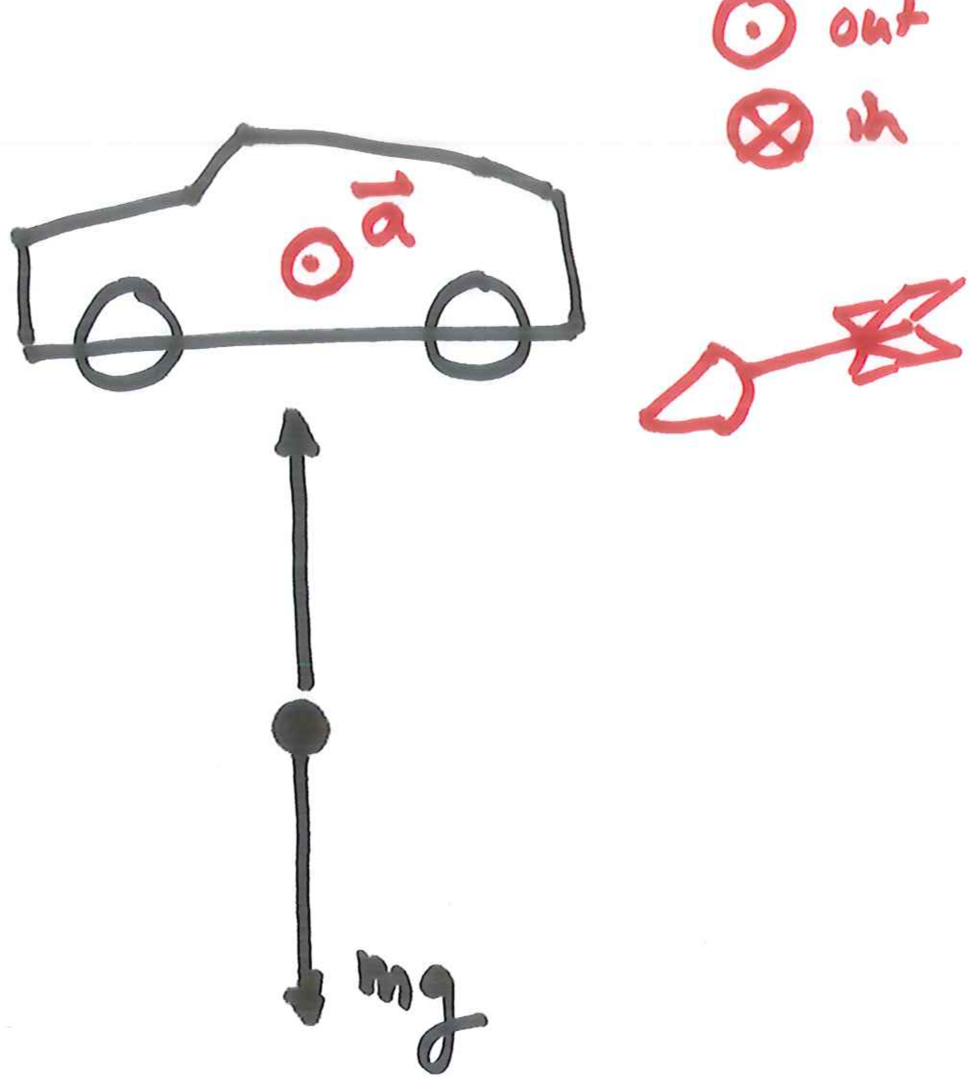
$$\Delta\theta = \frac{v}{R}\,\Delta t$$

$$|\vec{\Delta v}| = |\vec{v}|\,\Delta\theta = \underbrace{|\vec{v}|\,\frac{v}{R}}_{\frac{v^2}{R}}\,\Delta t$$

$$|\vec{a}| \equiv \left|\frac{\vec{\Delta v}}{\Delta t}\right| = \frac{v^2}{R}$$

$$\begin{cases} x(t) = R\cos\left(\frac{2\pi t}{T}\right) \\ y(t) = R\sin\left(\frac{2\pi t}{T}\right) \end{cases} \qquad \begin{cases} V_x(t) = -\frac{2\pi R}{T}\sin\left(\frac{2\pi t}{T}\right) \\ V_y(t) = \frac{2\pi R}{T}\cos\left(\frac{2\pi t}{T}\right) \end{cases}$$





$$\vec{F}_{net} = m\vec{a}$$