= Dudas tarea ==

8/10/21

Unidades → Simples → 1 dimensión tiempo [T]
→ metro (distancia) → [D]
Fundamental → D, T, C

→ Compuesta → > 1 dimensión Amperio $\frac{Q}{T}$

↓

Fundamentales

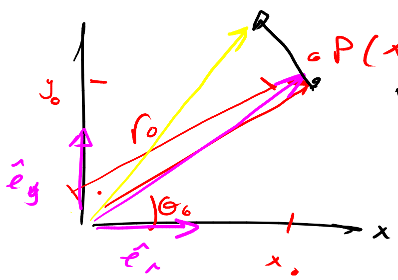
↳ Definiciones del SI ⟷ No son fundamentales

↳ cd → $\frac{W}{Area}$ → $\frac{Jm}{s^3 m^2}$ → $\boxed{\frac{kg\,m^2}{s^3 m^2}}$ $\frac{W}{m^2}$

↓

→ $\frac{W}{srad}$ ←

→ Vectores y coordenadas polares —



$P(x_0,y_0) = P(r_0, \theta_0)$

coordenadas

$r_0 = \sqrt{x_0^2 + y_0^2}$ → Número

$\theta_0 = \arctan\left(\frac{y_0}{x_0}\right)$ — Número

$\vec{P} = \overline{OP} = (x_0, y_0) - (0,0) = x_0\hat{e}_x + y_0\hat{e}_y$

flechita

$= r_0\hat{e}_r$

$\hat{e}_r = (\cos\theta\,\hat{e}_x + \sin\theta\,\hat{e}_y)$

$r_0\cos\theta = x_0$

$y_0 \sin\theta = y_0$

$\hat{e}_\theta = (-\sin\theta, \cos\theta)$

$$\begin{pmatrix}\hat{e}_r \\ \hat{e}_\theta\end{pmatrix} = \begin{pmatrix}\cos\theta & \sin\theta \\ -\sin\theta & \cos\theta\end{pmatrix}\begin{pmatrix}\hat{e}_x \\ \hat{e}_y\end{pmatrix} \longrightarrow \begin{aligned}\hat{e}_r &= \cos\theta\,\hat{e}_x + \sin\theta\,\hat{e}_y \\ \hat{e}_\theta &= -\sin\theta\,\hat{e}_x + \cos\theta\,\hat{e}_y\end{aligned}$$

Nuestro espacio es

$\mathbb{R}^3 = \mathbb{R}\times\mathbb{R}\times\mathbb{R}$

$\hat{e}_x = \_\_\_\_\ \hat{e}_r + \_\_\_\_\ \hat{e}_\theta$

$\hat{e}_y = \_\_\_\_\ \hat{e}_r + \_\_\_\_\ \hat{e}_\theta$

Espacio vectorial → Necesito tres vectores para construir nuestro espacio

$\vec{r} = a\hat{e}_x + b\hat{e}_y + c\hat{e}_z = a'\hat{e}_r + b'\hat{e}_\theta + c'\hat{e}_\varphi$

Dudas de cinemática

$\vec{V}_o \Rightarrow \|\vec{V}_o\| = cte$ Dirección constante

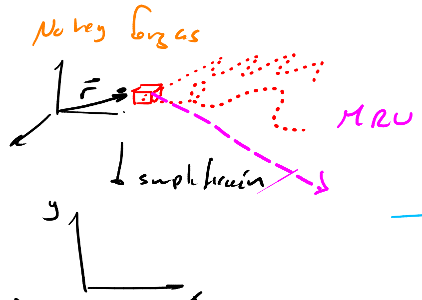
$\vec{a} = \vec{0}$ $\quad \vec{a} = \frac{d\vec{v}}{dt} = \frac{d^2\vec{r}}{dt}$

$\vec{V} = \vec{V_o}$, $\vec{r} = \vec{r_o} + \vec{V_o}\Delta t$

→ Marco de referencia inercial

→ 1ra ley de Newton

No hay fuerzas



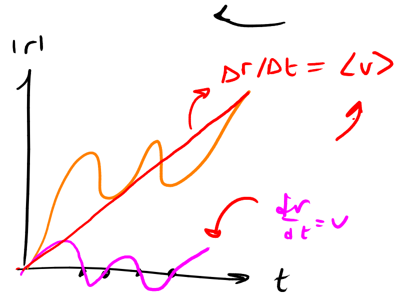
$\langle \vec{V} \rangle = \frac{\Delta \vec{r}}{\Delta t} \xrightarrow[\Delta t \to 0]{} \frac{d\vec{r}}{dt} = \vec{V}$ $\quad z = 0$

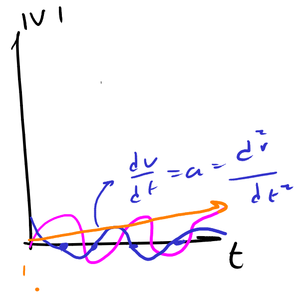
$\vec{r} \equiv$ radio vector $\quad \vec{r} = x\hat{e}_x + y\hat{e}_y$

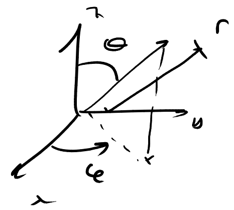
$= r\hat{e}_r$

$r^2 = x^2 + y^2$, $\theta = \arctan(\frac{y}{x})$

$\hat{e}_r = (\cos\theta, \sin\theta)$







Tarea

5:30 am

$V_o = 100 km$ $\quad a = 2 km\, hr^{-2}$

$\vec{V}_o = 100 kms$

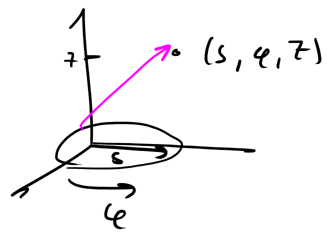
5am

¿a qué hora se alcanzan?

$\vec{r} = (\sin\theta\cos\varphi, \sin\theta\sin\varphi, \cos\theta)r$

$\vec{r} = s\hat{e}_s = s\cos\varphi\,\hat{e}_x + s\sin\varphi\,\hat{e}_y + z\hat{e}_z$

$s = \sqrt{x^2 + y^2}$



a →

$\frac{dv}{dt} = a \Rightarrow \Delta v = a\Delta t$

$\frac{dx}{dt} = v \Rightarrow \Delta x = V_o\Delta t + \frac{1}{2}a(\Delta t)^2$

Momento lineal

$\vec{p} = m\vec{v} \longrightarrow \vec{p}(t) = m(t)\,\vec{v}(t)$ ~ inercia

constantemente

$\boxed{\frac{d}{dt} f = \dot{f}}$

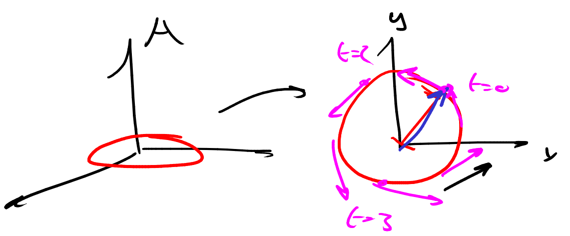
$\boxed{\vec{F} = \frac{d}{dt}\vec{p} = \frac{dm}{dt}\vec{v} + m\frac{d\vec{v}}{dt}}$

$\dot{\vec{p}}$

$\boxed{\frac{d}{dx} \to \nabla}$

1D

Movimiento circular (acelerado)



$\vec{V} = \cancel{\vec{V_o} = cte} \longrightarrow \|\vec{V}_o\| = cte$

$\|\vec{V}\| = \left\|\frac{d\vec{r}}{dt}\right\| \longrightarrow \|\vec{r}\| = cte$

$\vec{r} = r_o\hat{e}_r$ $\quad \hat{e}_r = \cos\theta\,\hat{e}_x + \sin\theta\,\hat{e}_y$

$\theta = \theta(t)$

$\dot{\vec{r}} = \cancel{\dot{r}_o\hat{e}_r} + r(\dot{\hat{e}_r}) = r(\dot{\hat{e}_r})$

$$\dot{\hat{e}}_r = \frac{d}{dt}\left(\cos\theta\, \hat{e}_x + \sin\theta\, \hat{e}_y\right) = -\sin\theta\, \dot{\theta}\, \hat{e}_x + \cos\theta\, \dot{\theta}\, \hat{e}_y$$

$$= \dot{\theta}\left(-\sin\theta\, \hat{e}_x + \cos\theta\, \hat{e}_y\right)$$

$$= \dot{\theta}\, \hat{e}_\theta$$

$$\frac{d f(g(x))}{dx} = \frac{d f(g(x))}{d(g(x))}\frac{d\, g(x)}{dx}$$

regla de la cadena

$$\dot{\vec{r}} = r_0\dot{\theta}\, \hat{e}_\theta \longrightarrow \ddot{\vec{r}} = \overset{a_c}{\underset{\text{hacia el centro}}{-r_0\dot{\theta}^2}}\, \overset{\text{radial}}{\hat{e}_r}$$

sup. $\ddot{\theta} = 0$

$$r\dot{\theta} = V_t$$

$$\dot{\theta} = \omega \rightarrow \left[\frac{2\pi}{s} = \frac{rad}{s}\right]$$

Ejemplo.

$\dot{\theta} = cte$

Un cuerpo gira uniformemente describiendo un círculo con un radio de 10 m, realizando una vuelta cada 2 minutos sobre un mismo plano. Describir en coordenadas cartesianas su velocidad. ¿Cuál es su vector de aceleración?

$$\boxed{\dot{\theta} = \omega = 2\pi f}$$

$$f = \frac{1}{2\,min}$$

$r = 10\,m$

vel. ang — Rouven ayular

$$\omega = 2\pi f = \dot{\theta} = \frac{2\pi}{2\cdot 60}\,\frac{rad}{s} \leftarrow \frac{1}{2\,min}\cdot\frac{min}{seg\ 60} = \frac{1}{2\cdot 60}\,\frac{1}{s}$$

$$\dot{\vec{r}} = \hat{e}_\theta\, r\dot{\theta} = \hat{e}_\theta\, r\omega = \hat{e}_\theta\, \frac{\cancel{10}\cdot\cancel{2}\pi}{\cancel{2}\cdot 6\cancel{0}}\,\frac{m}{s} = \frac{\pi}{6}\left(-\sin\theta, \cos\theta\right)$$

$$= \frac{\pi}{6}\left(-\sin(\omega t)\,\hat{e}_x + \cos(\omega t)\,\hat{e}_y\right)$$

$$\theta(t) \longrightarrow \dot{\theta} = \omega = \frac{d\theta}{dt}$$

$$\Rightarrow \int d\theta = \int \omega\, dt$$

$$\theta(t) = \omega\Delta t + \cancel{\theta_0} \Rightarrow \theta = \omega t$$

$t_0 = 0$

$$V_x = -\frac{\pi}{6}\sin(\omega t)$$

$$V_y = \frac{\pi}{6}\cos(\omega t)$$

$$\ddot{\vec{r}} = -r\dot{\theta}^2\,\hat{e}_r = -10\left(\frac{2\pi}{2\cdot 60}\right)^2\hat{e}_r$$

$$= -\frac{\pi}{6}\left(\frac{2\pi}{2\cdot 60}\right)\hat{e}_r = -\frac{2\pi^2}{20\cdot 6^2}\left(\cos(\omega t)\,\hat{e}_x + \sin(\omega t)\,\hat{e}_y\right)$$