DD MM

2.

$$x = R \operatorname{Sen} \theta \cos \varphi$$

$$y = R \operatorname{Sen} \theta \sin \varphi$$

$$z = r \cos \theta$$

$$\theta \rightarrow \text{ctte} \rightarrow d\theta = 0$$

$$ds = \sqrt{dr^2 + \cancel{r^2 d\theta^2} + r^2 \operatorname{Sen}^2 \theta \, d\phi^2}$$

$$ds^2 = dr^2 + r^2 \operatorname{Sen}^2 \theta \, d\phi^2 \quad \frac{d\phi^2}{d\phi^2}$$

$$ds^2 = \frac{dr}{d\phi} + r^2 Sen^2\theta$$

$$ds = \sqrt{\left(\frac{dr}{d\phi}\right)^2 + r^2 sen^2\theta}\, d\phi$$

$f((r, r', \phi$

$$f(r, r', \phi) = \sqrt{r'^2 + r^2 Sen^2\theta}$$

$$\frac{\partial f}{\partial r} = \frac{r sen^2\theta}{\sqrt{r'^2 + r^2 Sen^2\theta}}$$

$$\frac{\partial f}{\partial r'} = \frac{r'}{\sqrt{r'^2 + r^2 sen\theta}}$$

$$\frac{d}{d\phi}\left(\frac{\partial f}{\partial r'}\right) = \frac{r''\sqrt{r'^2 + r^2 Sen^2\theta} - \dfrac{r'^2 \cdot r''}{\sqrt{r'^2 + r^2 Sen^2\theta}}}{r'^2 + r^2 Sen^2\theta}$$

$$= \frac{r''\left(\dfrac{(r'^2 + r^2 Sen^2\theta) - r'^2}{\sqrt{r'^2 + r^2 Sen^2\theta}}\right)}{r'^2 + r^2 Sen^2\theta}$$

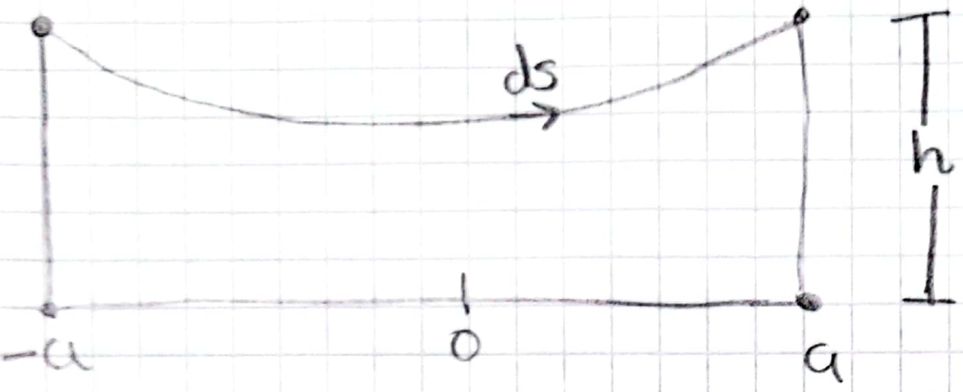
$$= \frac{r'' r^2 Sen^2\theta)}{(r'^2 + r^2 Sen^2\theta)^{3/2}}$$

$$\frac{r\,\mathrm{sen}^2\theta}{\sqrt{r'^2 + r^2\mathrm{sen}^2\theta}} - \frac{r''\,r^2\,\mathrm{sen}^2\theta}{\left(r'^2 + r^2\mathrm{sen}^2\theta\right)^{3/2}} = 0$$

$$r(\phi) = c_2\, e^{c_1\phi + \frac{\phi^2\mathrm{sen}^2\theta}{2}}$$

3.

Cable flexible de longitud L



$$L = \int_{-a}^{a} ds$$

$$ds^2 = dx^2 + dy^2$$

$$ds^2 = \left(\frac{dx^2}{dx^2}\right)dx^2 + \left(\frac{dy^2}{dx^2}\right)dx^2$$

$$L = \int_{-a}^{a} \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\, dx$$

$$ds = \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\, dx$$

Suponiendo un cable de densidad λ constante

Podemos definir la función energía potencial U como

$$U = \int_{-a}^{a} y g \lambda \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\, dx$$

Aplicando principio variacional para la funcion

$$f(y,y',x) = yg\lambda\sqrt{1+y'^2}$$

$(1+y'^2)^{1/2}$

Usamos las ecuaciones de euler lagrange

$\frac{1}{2}(1+y'^2)^{-1/2} 2y'$

$$\frac{\partial f}{\partial y} = g\lambda\sqrt{1+y'^2}$$

$$\frac{\partial f}{\partial y'} = yg\lambda \cdot \frac{y'}{\sqrt{1+y'^2}}$$

$$g\lambda\sqrt{1+y'^2} - \frac{d}{dx}\left(g\lambda y \cdot \frac{y'}{\sqrt{1+y'^2}}\right) = 0$$

$$y(x) = a\cosh\left(\frac{x-c_1}{a}\right) + c_2$$

Si se quiere minimizar la energia potencial gravitacional, los cables tienden a tomar la forma de una catenaria