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Si $\frac{d^2y}{dt^2} + g - \gamma^2\left(\frac{dy}{dt}\right)^2 = 0$

Si tomamos $\frac{dy}{dt} = v(t)$

$$\frac{dv}{dt} + g - \gamma^2(v(t))^2 = 0$$

Por separable.

$$\int \frac{dv}{g - \gamma^2 v^2} = \int dt$$

$$\frac{1}{g}\int \frac{dv}{\left(1 - \frac{\gamma^2}{g}v^2\right)} \Rightarrow$$

Si $u = \frac{i \cdot \gamma}{\sqrt{g}} v$

$$\frac{\sqrt{g}\,du}{i\,\gamma} = dv$$

$$\frac{1}{\sqrt{r}\sqrt{g}}\int_{v_0}^{v}\frac{du}{u^2+1} = \frac{1}{\sqrt{r}\sqrt{g}}\tan^{-1}(u)$$

$$= -\frac{1}{\sqrt{r}\sqrt{g}}\tanh^{-1}\left(\frac{\sqrt{r}}{\sqrt{g}}v\right) = t$$

$$\frac{1}{\sqrt{r}\sqrt{g}}\tanh^{-1}\left(\frac{\sqrt{r}}{\sqrt{g}}v\right) = -t + \frac{1}{\sqrt{r}\sqrt{g}}\tanh^{-1}\left(\frac{\sqrt{r}v_0}{\sqrt{g}}\right)$$

$$r\tanh^{-1}\left(\frac{\sqrt{r}}{\sqrt{g}}v\right) = -\sqrt{r}\sqrt{g}t + \tanh^{-1}\left(\frac{\sqrt{r}v_0}{\sqrt{g}}\right)$$

$$\frac{\sqrt{r}}{\sqrt{g}}v = \tanh\left(-\sqrt{r}\sqrt{g}t + \tanh^{-1}\left(\frac{\sqrt{r}v_0}{\sqrt{g}}\right)\right)$$

$$v = \frac{\sqrt{g}}{\sqrt{r}}\tanh\left(\qquad\right)$$

//

$$V(t) = \frac{\sqrt{g}}{\sqrt{\gamma'}} \tanh\left(-\sqrt{\gamma'}\sqrt{g}\, t + \tanh^{-1}\left(\frac{\sqrt{\gamma'}\, V_0}{\sqrt{g}} \right) \right)$$

Si $\gamma = \sqrt{\frac{c\rho A}{2m}} = \sqrt{\gamma'}$

$$\therefore V(t) = \frac{\sqrt{g}}{\gamma} \tanh\left(-\gamma\sqrt{g}\, t + \tanh^{-1}\left(\frac{\gamma V_0}{\sqrt{g}} \right) \right)$$

$$= \int_0^t \frac{\sqrt{g}}{\gamma} \tanh\left(-\gamma\sqrt{g}\, t + \tanh^{-1}\left(\frac{\gamma\, V_0}{\sqrt{g}} \right) \right) dt$$

$$= \frac{\sqrt{g}}{\gamma} \int_0^t \tanh\left(-\gamma\sqrt{g}\, t + \tanh^{-1}\left(\frac{\gamma\, V_0}{\sqrt{g}} \right) \right) dt$$

$$u = t\,\gamma\sqrt{g} + \tanh^{-1}\left(\frac{\gamma V_0}{\sqrt{g}} \right)$$

$$du = \gamma\sqrt{g}\, dt \Rightarrow \frac{du}{\gamma\sqrt{g}} = dt$$

$$\frac{\sqrt{\cancel{g}}}{\sqrt{\gamma}}\ \frac{1}{\cancel{\sqrt{g}}\sqrt{\gamma}}\int \tanh(v)\,dv$$

$$= \frac{1}{\gamma^2}\int \frac{\operatorname{senh}(v)\,dv}{\cosh(v)} \quad \to \quad s = \cosh(v)$$

$$ds = \operatorname{senh}(v)\,dv$$

$$= \frac{1}{\gamma^2}\int \frac{ds}{s}$$

$$= \frac{1}{\gamma^2}\ln(s) = \frac{1}{\gamma^2}\ln(\cosh(v))$$

$$= \frac{1}{\gamma^2}\ln\left(\cosh\left(-t\gamma\sqrt{\gamma} + \tanh^{-1}\left(\frac{\gamma v_0}{\sqrt{g}}\right)\right)^{-1}\right)\Bigg|_0^t$$

$$= \frac{1}{\gamma^2}\ln\left(\frac{1}{\cosh\left(-t\gamma\sqrt{g} + \tanh^{-1}\left(\frac{\gamma v_0}{\sqrt{g}}\right)\right)}\right)\Bigg|_0^t$$

$$y(t) = y_0$$

$$+ \frac{1}{\gamma^2} \ln\left[\frac{\cosh\left(\tanh^{-1}\left(\frac{\gamma v_0}{\sqrt{g}}\right)\right)}{\cosh\left(-t\gamma\sqrt{g} + \tanh^{-1}\left(\frac{\gamma v_0}{\sqrt{g}}\right)\right)}\right] //$$

→ Punto 6 → parte 2

si $$\frac{dF}{dx} = \frac{F(x+h) - F(x-h)}{h}$$

si $$\frac{d''F}{dx^2} = \frac{F'(x+h) - F'(x-h)}{2h}$$

$$= \frac{\frac{F(x+h) - F(x)}{h} - \frac{F(x) - F(x-h)}{h}}{h}$$

$$= \frac{F(x+h) - 2F(x) + F(x-h)}{h^2}$$

si $\boxed{2h' = 2h}$

$$\frac{F(x+(2h')) - 2F(x) + F(x-2h')}{4(h')^2}$$

si $2h' \rightarrow$ es 2 pasos adelante de h.

$$\frac{F(x+2) - 2F(x) + F(x-2)}{4h^2}$$