1. Unidades:

$1F = \frac{22 \cdot 10^3}{17600} = 1,25$

$1D = \frac{30h}{5} = 6h = 360 min = 21600 s$

$1A = 44,01 g$

$1o = 0,04401 Kg \cdot 3,721 m/s^2 = 0,1637 N$

$1C = \frac{0,1637}{1,25^2} = 0,1048 Pa$

a) $\eta_{(60°)} = 0,4528 \cdot 10^{-3} Pa \cdot s \cong \boxed{0,453 \cdot 10^{-3} \frac{N}{m^2} \cdot s}$

Converter p/ nC·D

$0,453 \cdot 10^{-3} (\cancel{Pa} \cdot \cancel{s}) \cdot \frac{1C}{0,1048 \cancel{Pa}} \cdot \frac{1D}{21600 \cancel{s}}$

$= \frac{0,453 \cdot 10^{-3}}{2263,68} C \cdot D$

$= 0,2001029 \cdot 10^{-6} C \cdot D = 200,103 \cdot 10^{-9} C \cdot D$

$\boxed{= 200,103 \ nC \cdot D}$

b) $5F = 5 \cdot 1,25 = \boxed{6,25 m}$

c) $7D = 7 \cdot 360 = \boxed{2520 min}$

d) $8A = 44,01 \cdot 10^{-3} \cdot 8 = \boxed{0,352 Kg}$

e) $F = 65 \cdot 8 = \boxed{520\ N}$

$= 520\ \cancel{N} \cdot \frac{1o}{0{,}1637\ \cancel{N}}$

$= \boxed{3176{,}54\ o}$

Unidades:

$1F = 1{,}25\ m$

$1D = 21600\ s$

$1A = 44{,}01\ g$

$1o = 0{,}1637\ N$

$1C = 0{,}1048\ Pa$

f) Considerando $\boxed{71\ Kg}$

$P = \frac{71 \cdot 3{,}721}{0{,}8} = 330{,}24\ Pa$

$= 330{,}24\ \cancel{Pa} \cdot \frac{1C}{0{,}1048\ \cancel{Pa}}$

$= 3151{,}14\ C$

$\boxed{= 3{,}151\ KC}$

2. $\vec{v} = 0{,}1\,x\,\hat{i} + 0{,}001\,y\,(0{,}46 + 0{,}33t)\,\hat{j}$

Trajetória: $\frac{dx}{dt} = u$ $\qquad \frac{dy}{dt} = v$

$$\frac{dx}{dt} = 0{,}1x \qquad\qquad \frac{dy}{dt} = 10^{-3}y(0{,}46+0{,}33t)$$

$$\int_{x_0}^{x}\frac{dx}{x} = \int_{t_0}^{t}0{,}1\,dt \qquad\qquad \int_{y_0}^{y}\frac{dy}{y} = \int_{t_0}^{t}10^{-3}(0{,}46+0{,}33t)\,dt$$

$$\ln x\Big]_{x_0}^{x} = 0{,}1(t-t_0) \qquad\qquad \ln y\Big]_{y_0}^{y} = 10^{-3}(0{,}46t+0{,}165t^2)\Big]_{t_0}^{t}$$

$$\ln\frac{x}{x_0} = 0{,}1(t-t_0) \qquad\qquad \ln\frac{y}{y_0} = 0{,}46.10^{-3}(t-t_0)+0{,}165.10^{-3}(t^2-t_0^2)$$

$$\frac{x}{x_0} = e^{0{,}1(t-t_0)} \qquad\qquad \frac{y}{y_0} = e^{0{,}46.10^{-3}(t-t_0)+0{,}165.10^{-3}(t^2-t_0^2)}$$

$$x = x_0\,e^{0{,}1(t-t_0)} \qquad\qquad y = y_0\,e^{0{,}46.10^{-3}(t-t_0)+0{,}165.10^{-3}(t^2-t_0^2)}$$

$t_0 = 7s$

$x_0 = 1{,}9$; $y_0 = 3{,}25$

$$x = 1{,}9 \cdot e^{0{,}1(0-7)} \qquad\qquad y = 3{,}25\,e^{0{,}46.10^{-3}\cdot(0-7)+0{,}165.10^{-3}\cdot(0-7^2)}$$

$$x(0) = 0{,}9435 \qquad\qquad y(0) = 3{,}2135$$

$$x(10) = 1{,}9\,e^{0{,}1(10-7)} \qquad\qquad y(10) = 3{,}25\,e^{0{,}46.10^{-3}(10-7)+0{,}165.10^{-3}(10^2-7^2)}$$

$$= 2{,}5647 \qquad\qquad = 3{,}2820$$

• Linha de corrente: $\frac{dy}{dx} = \frac{v}{u}$

$$\frac{dy}{dx} = \frac{10^{-3} y (0,46 + 0,33t)}{0,1x}$$

$$\int \frac{dy}{y} = \int \frac{10^{-2}(0,46 + 0,33t)}{x} dx$$

$$\ln y = 10^{-2}(0,46 + 0,33t) \ln x + C_1$$

$$y = C x^{10^{-2}(0,46 + 0,33t)}$$

$(1,9 ; 3,25)$ $t = 7s$

$$3,25 = C \cdot 1,9^{10^{-2}(0,46 + 0,33 \cdot 7)}$$

$$3,25 = C \cdot 1,9^{0,0277}$$

$$C = 3,1927$$

- Já temos as equações da trajetória

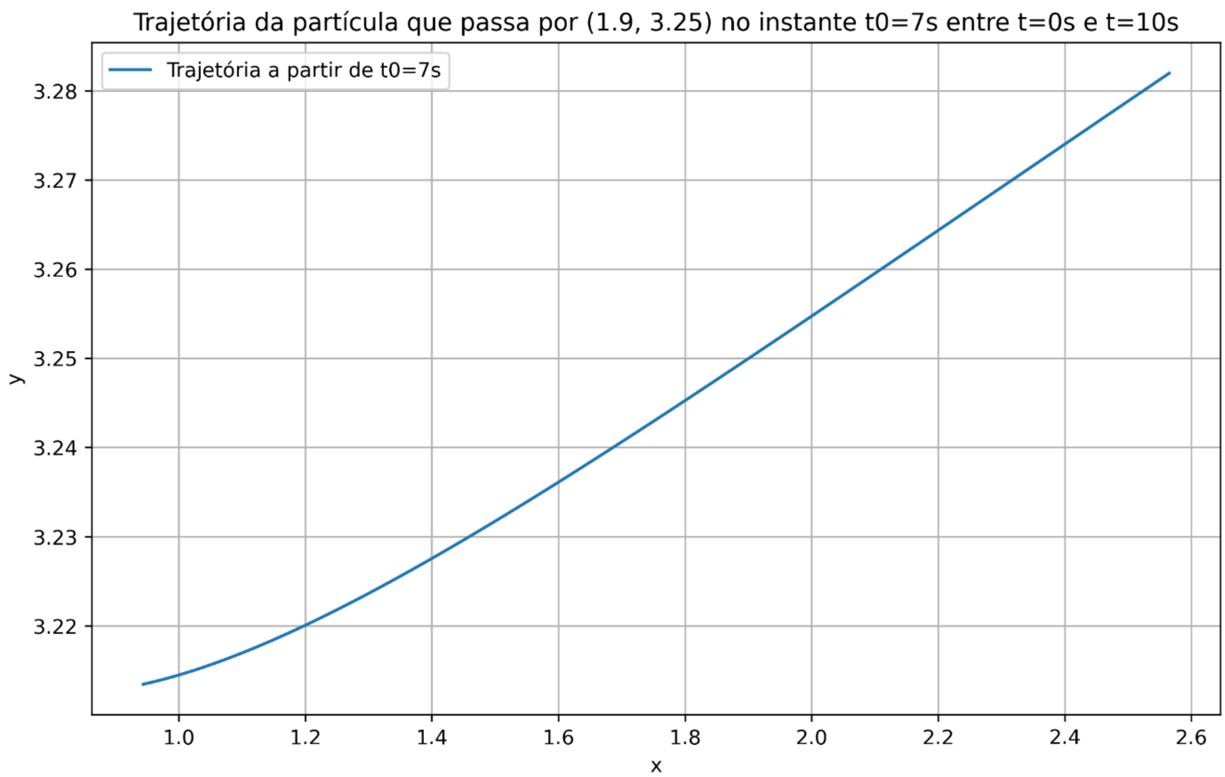
$x = x_0 e^{0,1(t-t_0)}$ $\qquad$ $y = y_0 e^{0,46 \cdot 10^{-3}(t-t_0)+0,165 \cdot 10^{-3}(t^2-t_0^2)}$

Usando $x_0 = 1,9$; $y_0 = 3,25$ e $t_0 = 7$, temos:

$x = 1,9 \cdot e^{0,1(t-7)}$ $\qquad$ $y = 3,25 e^{0,46 \cdot 10^{-3}(t-7)+0,165 \cdot 10^{-3} \cdot (t-7^2)}$

Em seguida, basta traçar entre $t=0$ e $t=10$.

Os gráficos foram gerados em Python.



• Equação para a linha de corrente:

$$\int_{3,25}^{y} \frac{dy}{y} = \int_{1,9}^{x} \frac{10^{-3}(0,46+0,33t)}{0,1x}\,dx$$

$$\ln y \Big]_{3,25}^{y} = 10^{-2}(0,46+0,33t)\ln x \Big]_{1,9}^{x}$$

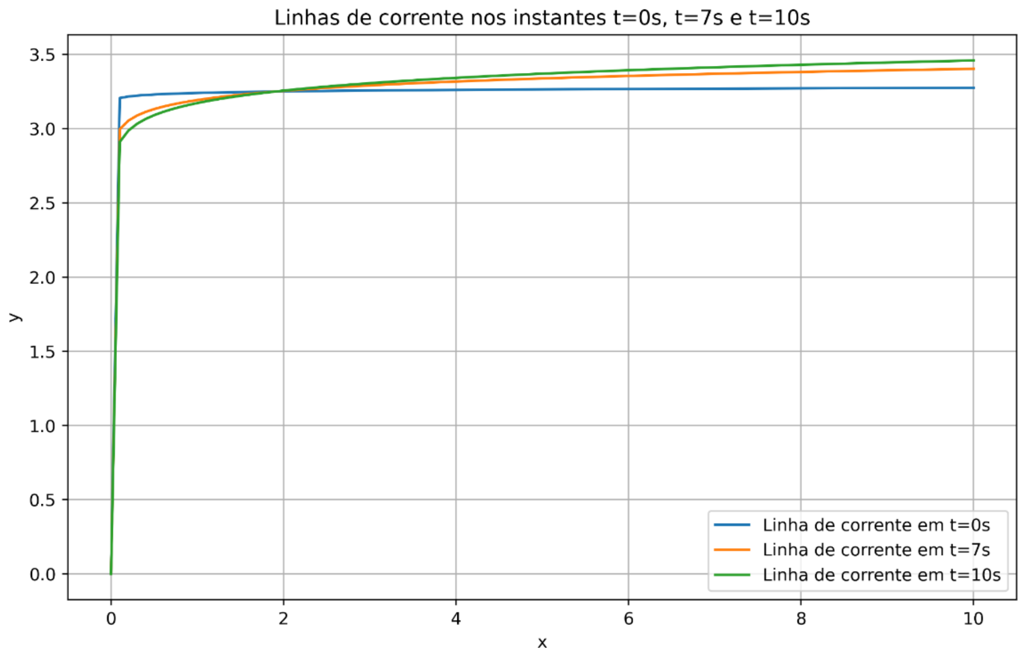
$$\ln y - \ln 3,25 = 10^{-2}(0,46+0,33t)(\ln x - \ln 1,9)$$

$$e^{\wedge}\left(\ln\left(\frac{y}{3,25}\right)\right) = e^{\wedge}\left(10^{-2}(0,46+0,33t)\ln\left(\frac{x}{1,9}\right)\right)$$

$$\frac{y}{3,25} = \left(\frac{x}{1,9}\right)^{10^{-2}(0,46+0,33t)}$$

$$y = 3,25\left(\frac{x}{1,9}\right)^{10^{-2}(0,46+0,33t)}$$

Então basta gerar as figuras para (1,9;3,25) nos tempos t=0; t=7 e t=10.



- Para linha de emissão:

$X(t_0) = X_0 e^{0,1(t-t_0)}$ $\quad$ $Y(t_0) = Y_0 e^{0,46 \cdot 10^{-3}(t-t_0) + 0,165 \cdot 10^{-3}(t^2-t_0^2)}$

Que passaram por $(1,9; 3,25)$ em $t=7$ e $t=10$

$X_0 = 0,9435$ $\quad$ $Y_0 = 3,2135$

Agora, gerar gráficos com t_0 variando