

# Universidade Federal do Rio Grande do Norte

## Engenharia Elétrica

### Projeto Métodos Computacionais

Grupo 4:

Alan Lima de Medeiros

Clayton Rylmer Paiva Maia de Almeida

Enzo Hêndrio Gomes Araújo

João Lucas Freitas Dantas Borges

06/2022

# Respositório



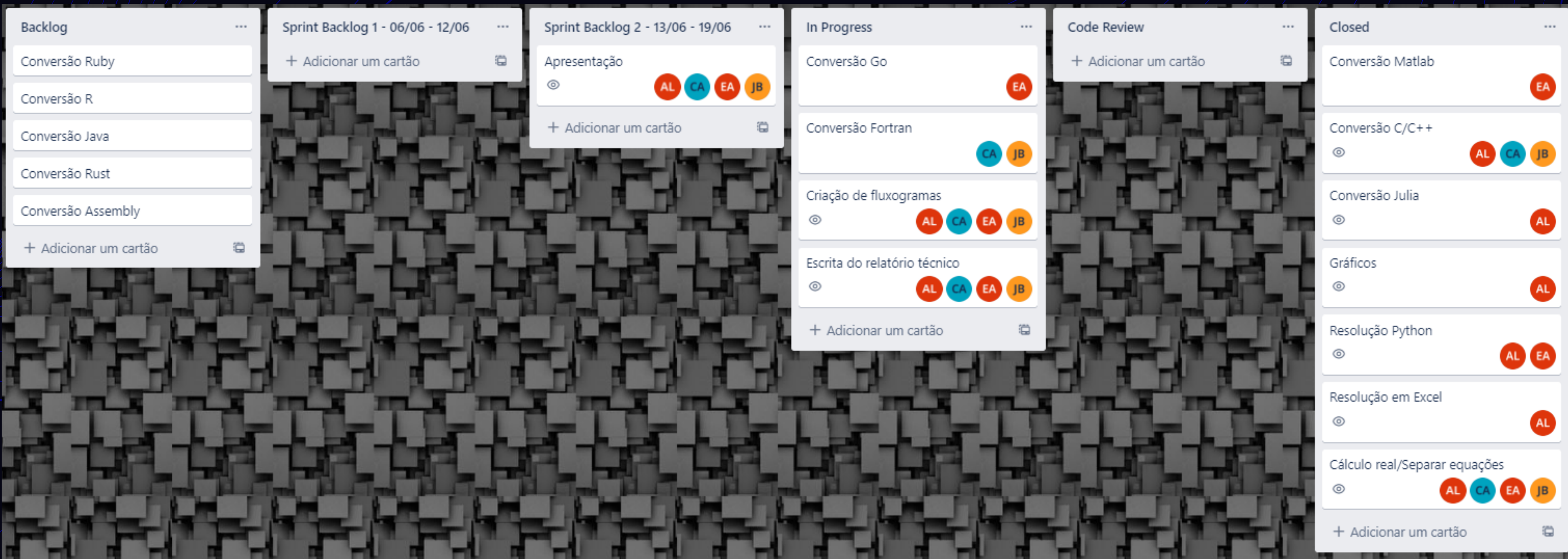
# Metodologia

- Metodologia ágil: Scrum
- Sprints: 2
- Sprint 1: 06/06 - 12/06
- Sprint 2: 13/06 - 19/06

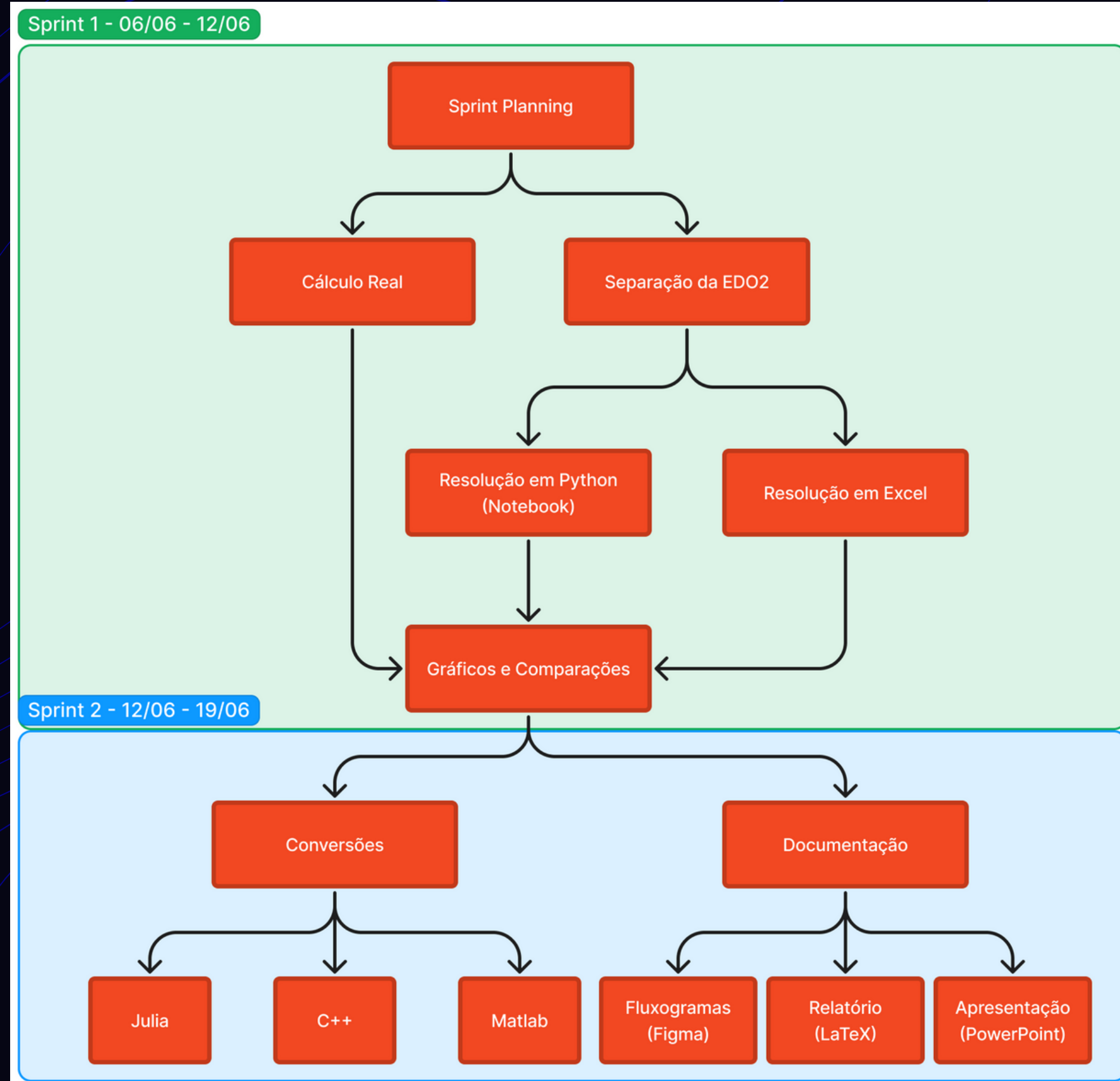




# Metodologia - Trello



# Metodologia - Divisão Sprints



# Metodologia

- Por que metodologia ágil?
- Por que o Excel primeiro?
- Por que usar ferramentas em nuvem?
- Por que várias linguagens?



# Problema

$$\frac{d^2 y(x)}{dx^2} = - \left( 100 + \frac{1}{x^2} \right) y(x) = f(x, y)$$

$$y(1) = -0.24593576$$

$$y'(1) = -0.55769344$$

Intervalo:  $[1, 10\pi]$

$h = [0.025, 0.25, 0.5]$

# Separação

$$\frac{d^2 y(x)}{dx^2} = - \left( 100 + \frac{1}{x^2} \right) y(x) = f(x, y)$$

$$z = y' \rightarrow z(1) = y'(1) = -0.55769344$$

$$z' = y'' = - \left( 100 + \frac{1}{x^2} \right) y(x)$$



# Equações - RK4

$$y_{n+1} = y_n + \frac{1}{6} \underline{(k_1 + 2k_2 + 2k_3 + k_4)} \quad z_{n+1} = z_n + \frac{1}{6} \underline{(l_1 + 2l_2 + 2l_3 + l_4)}$$

$$k_1 = h z_n$$

$$l_1 = h f(x_n, y_n)$$

$$k_2 = h \left( z_n + \frac{l_1}{2} \right)$$

$$l_2 = h f \left( x_n + \frac{h}{2}, y_n + \frac{k_1}{2} \right)$$

$$k_3 = h \left( z_n + \frac{l_2}{2} \right)$$

$$l_3 = h f \left( x_n + \frac{h}{2}, y_n + \frac{k_2}{2} \right)$$

$$k_4 = h(z_n + l_3)$$

$$l_4 = h f(x_n + h, y_n + k_3)$$

# Equações - RK6 Collatz

$$y_{n+1} = y_n + h z_n \frac{1}{90} (7k_0 + 24k_1 + 6k_2 + 8k_3) \quad z_{n+1} = z_n + \frac{1}{90h} (7k_0 + 32k_1 + 12k_2 + 32k_3 + 7k_4)$$

$$k_0 = h^2 f(x_n, y_n)$$

$$k_1 = h^2 f\left(x_n + \frac{1}{4}h, y_n + \frac{1}{4}h z_n + \frac{1}{32}k_0\right)$$

$$k_2 = h^2 f\left(x_n + \frac{1}{2}h, y_n + \frac{1}{2}h z_n - \frac{1}{24}k_0 + \frac{1}{6}k_1\right)$$

$$k_3 = h^2 f\left(x_n + \frac{3}{4}h, y_n + \frac{3}{4}h z_n + \frac{3}{32}k_0 + \frac{1}{8}k_1 + \frac{1}{16}k_2\right)$$

$$k_4 = h^2 f\left(x_n + h, y_n + h z_n + \frac{3}{7}k_1 - \frac{1}{14}k_2 + \frac{1}{7}k_3\right)$$

# Excel

- 6 planilhas
- Aplicação das fórmulas
- Tabelamento dos resultados
- Gráficos

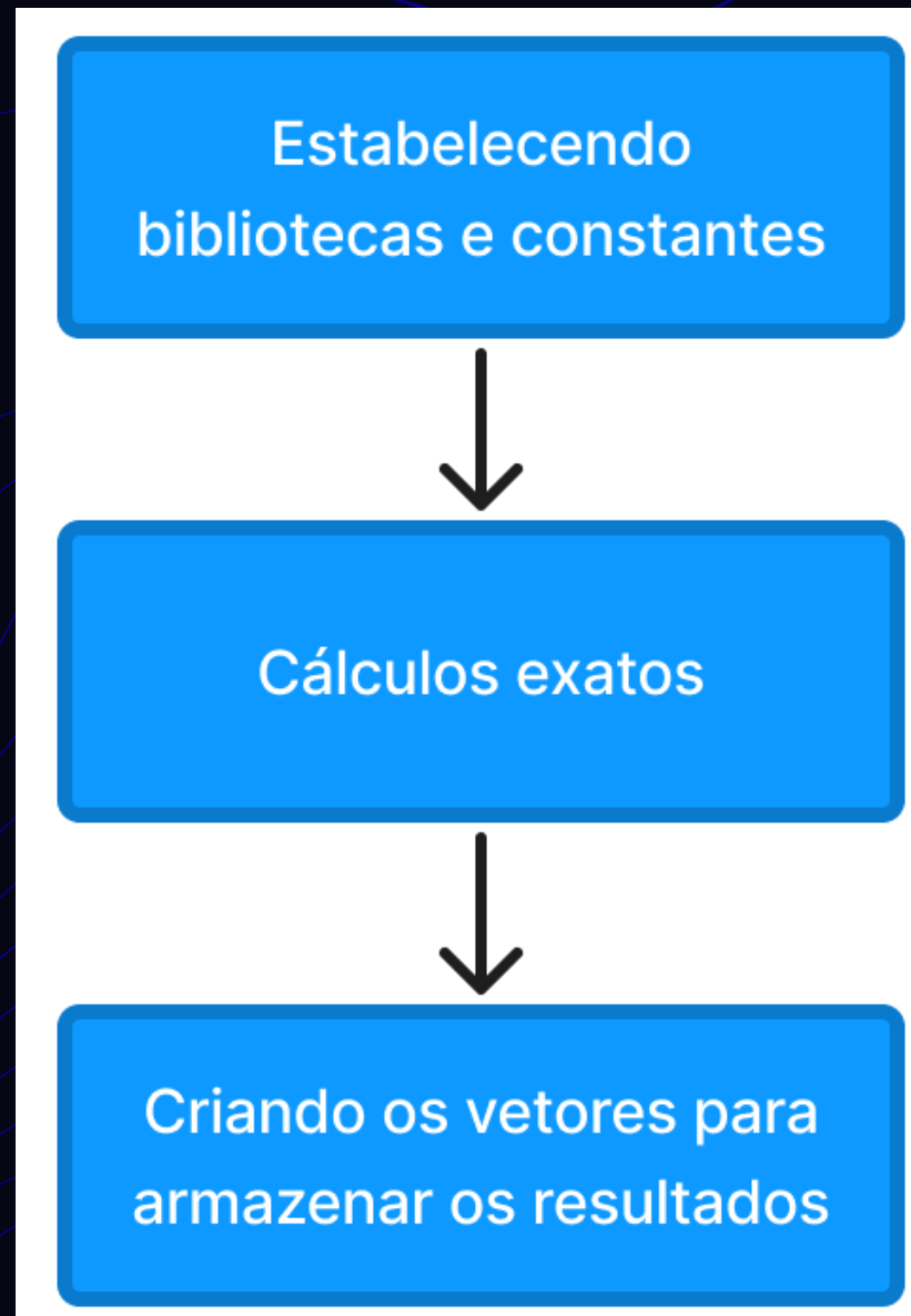




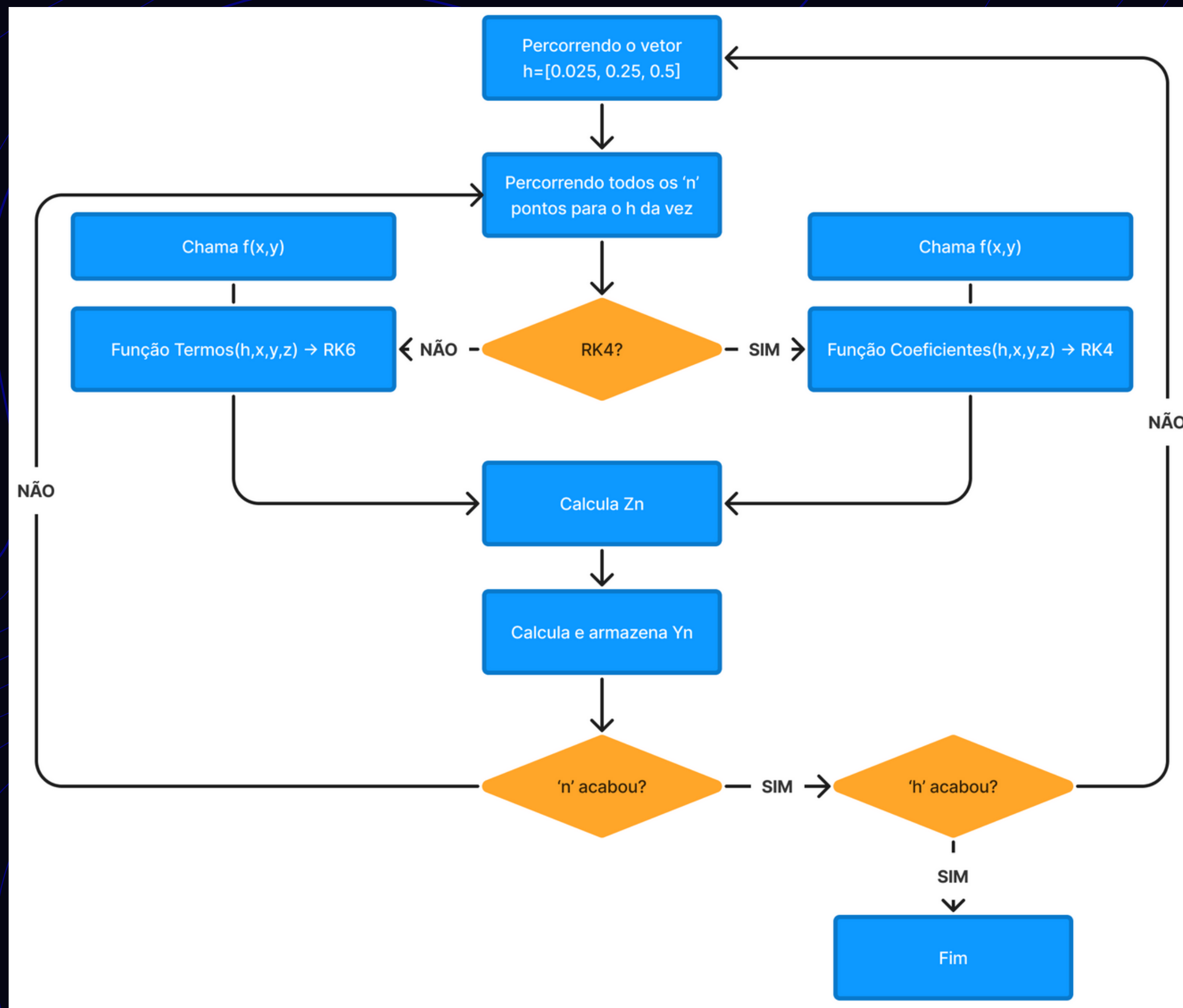
# Python



# Python - Resolução



# Python - Resolução





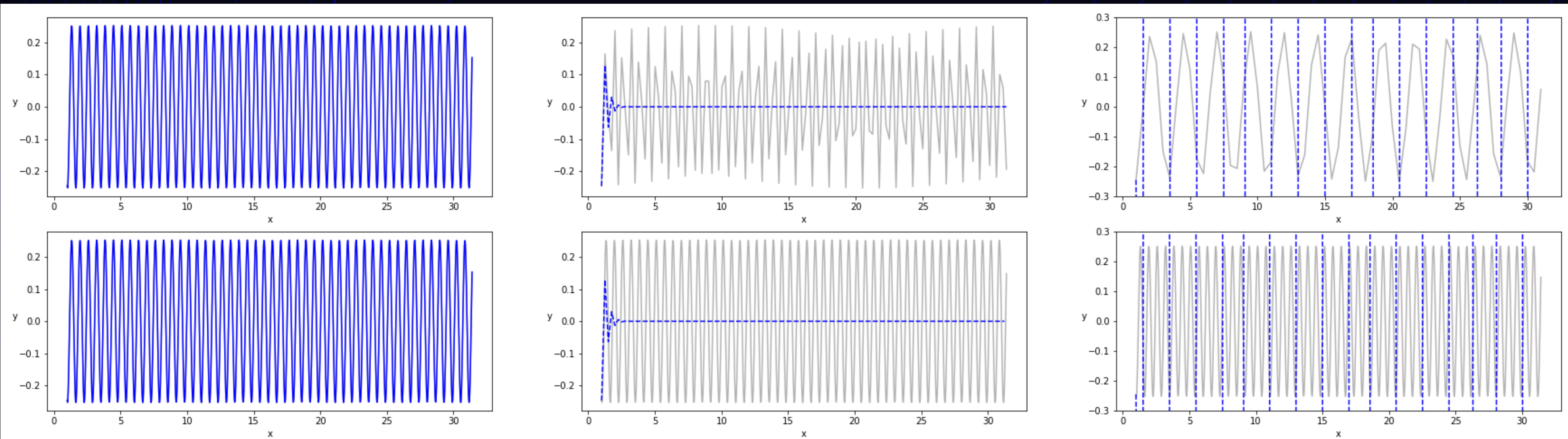
# Conversões

- Índices e vetores
- Bibliotecas
- Operações matemáticas
- Sintaxe

# Conversões

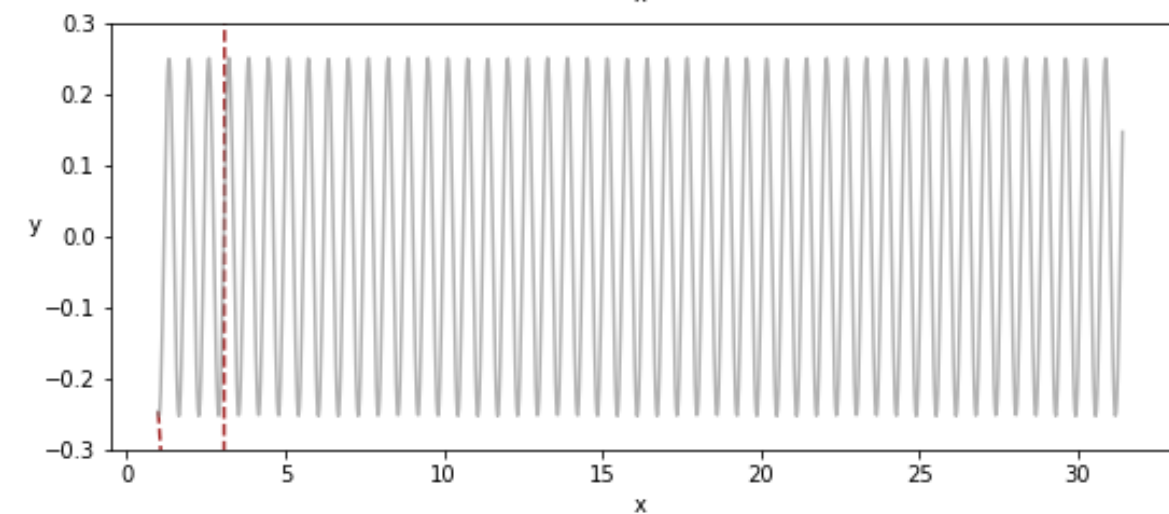
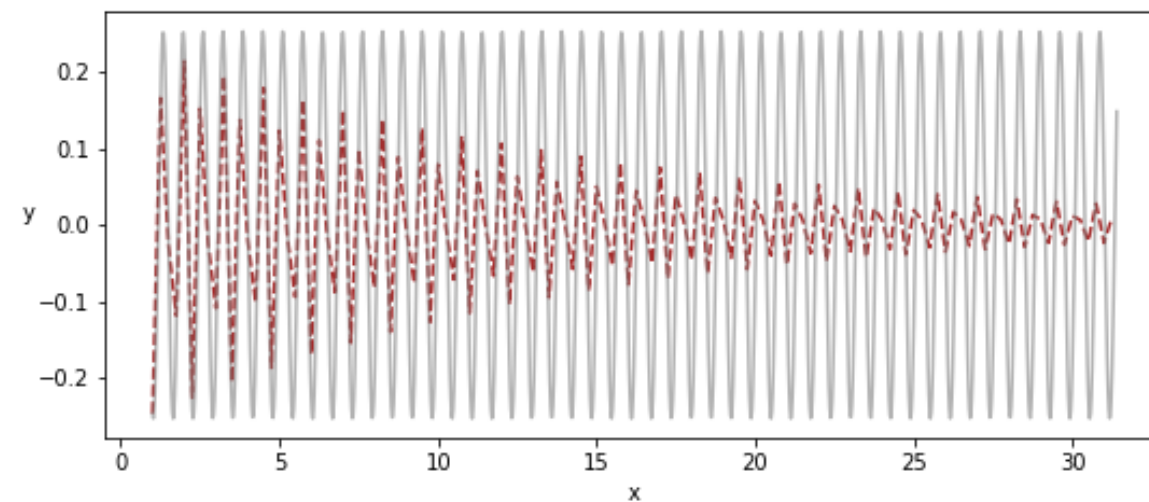
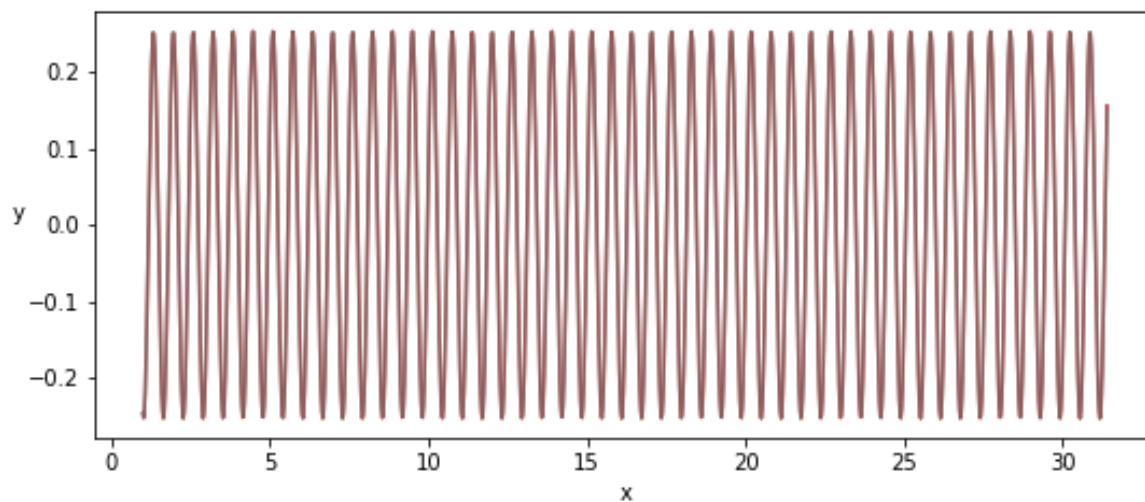
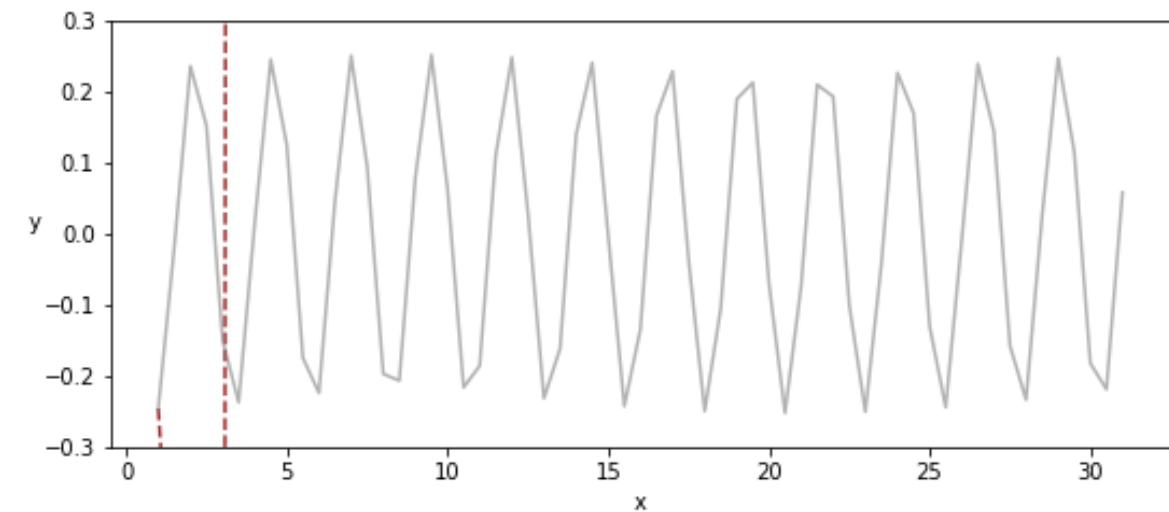
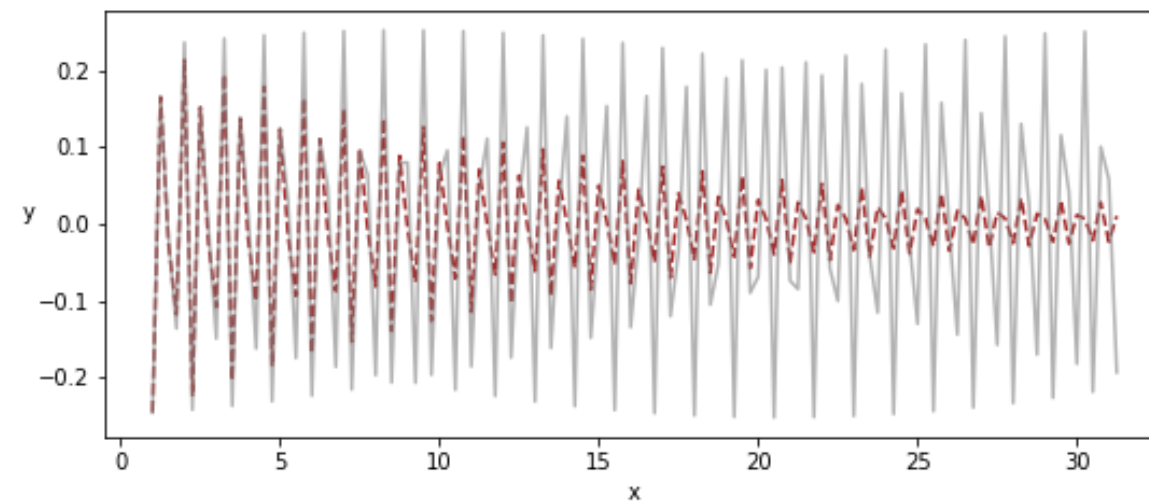
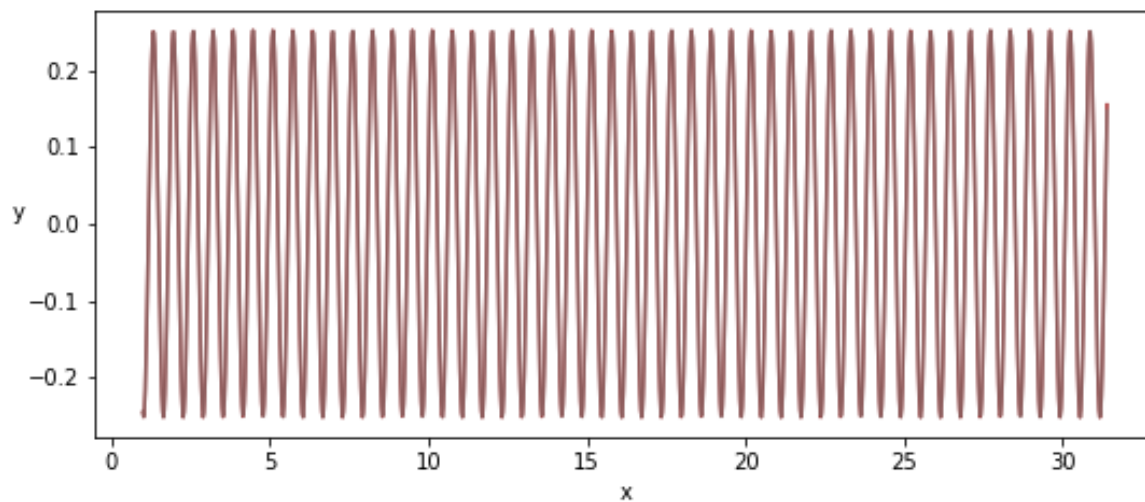


# Análises - RK4

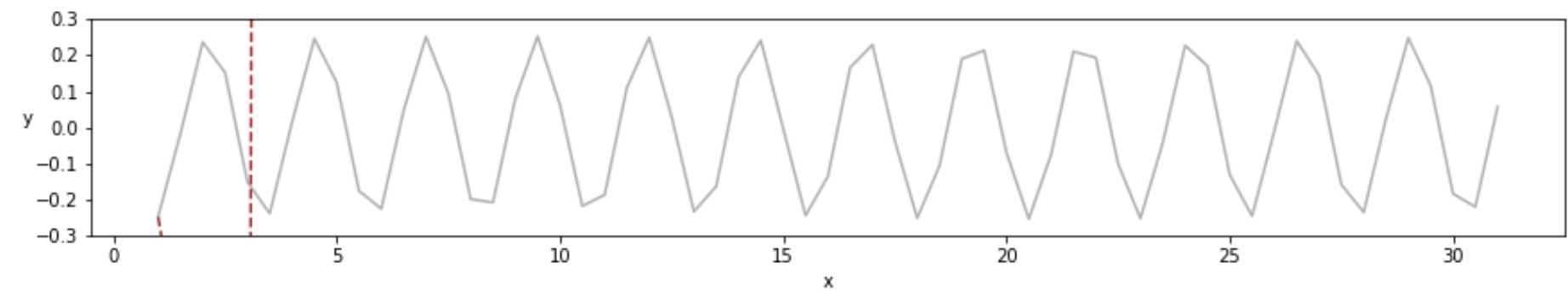
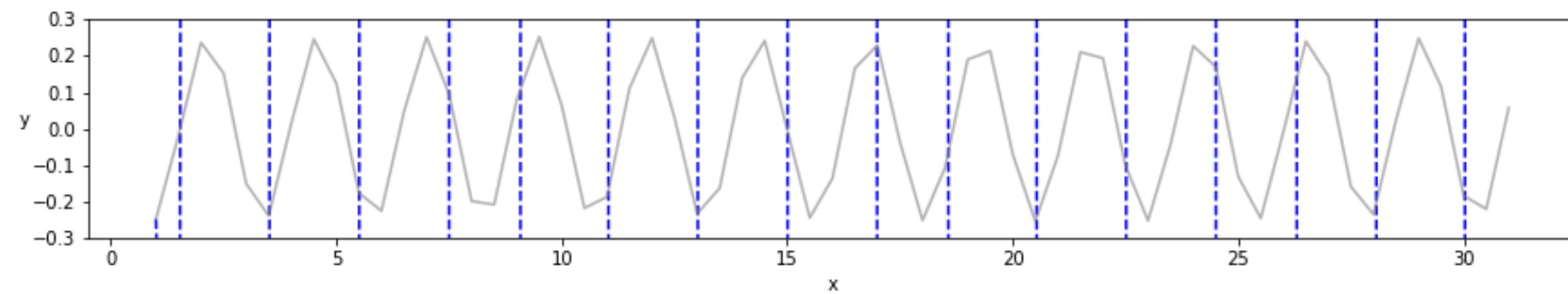
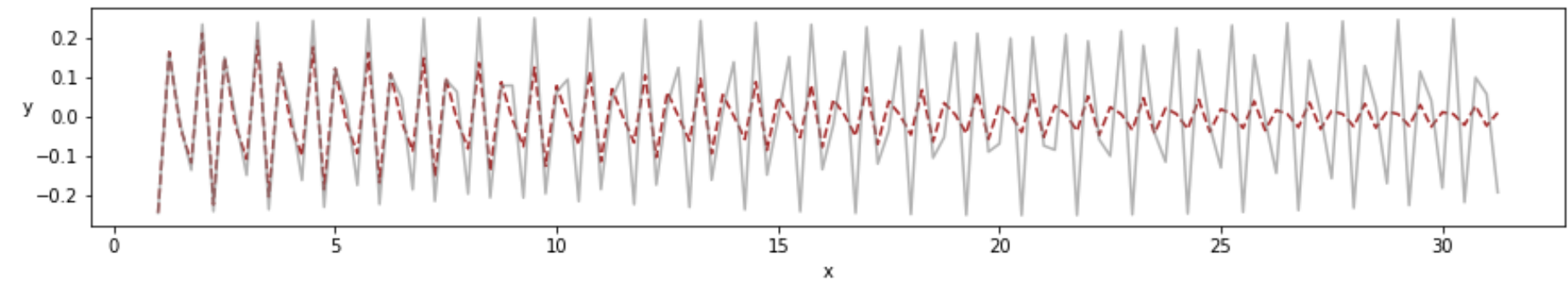
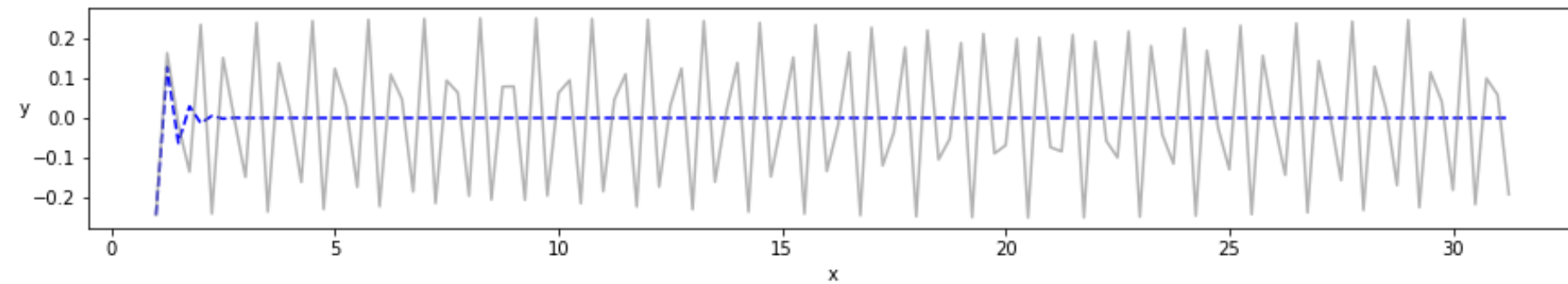
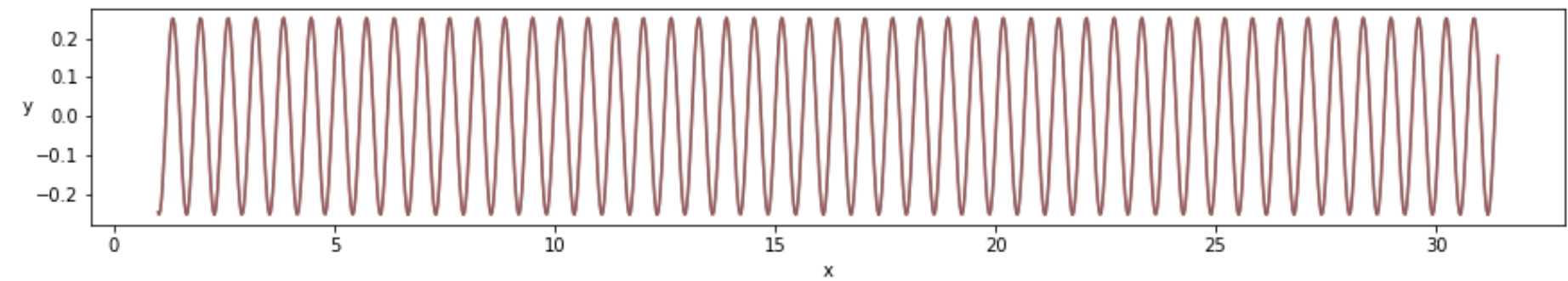
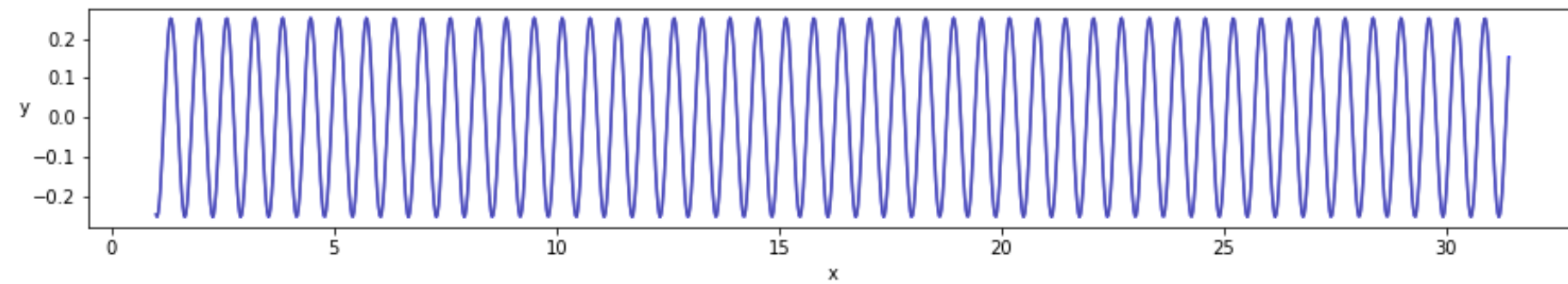




# Análises - RK6

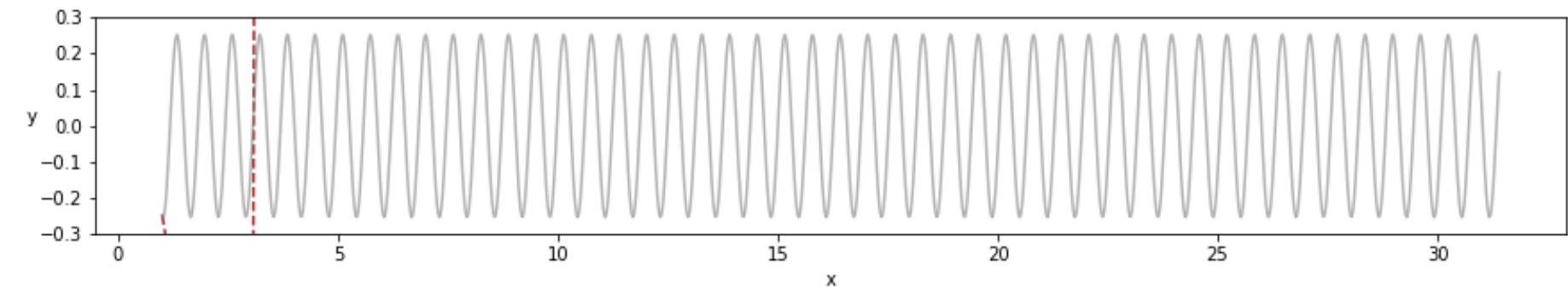
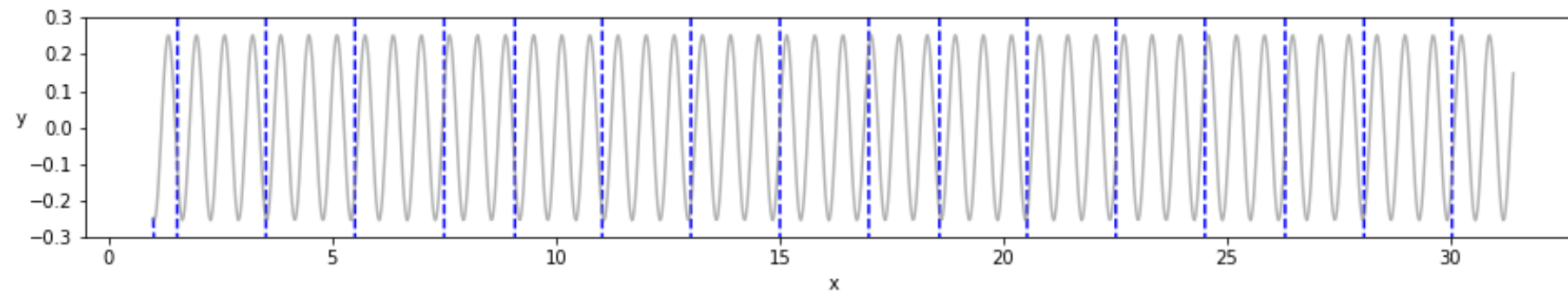
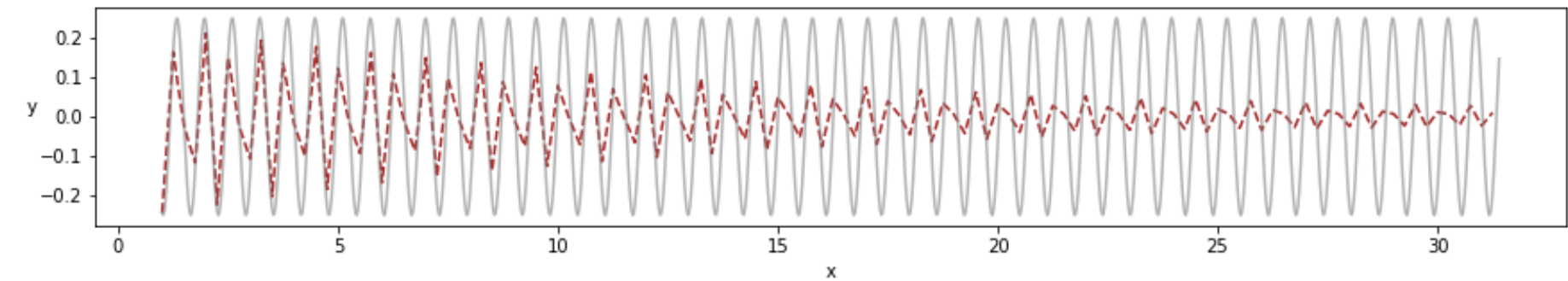
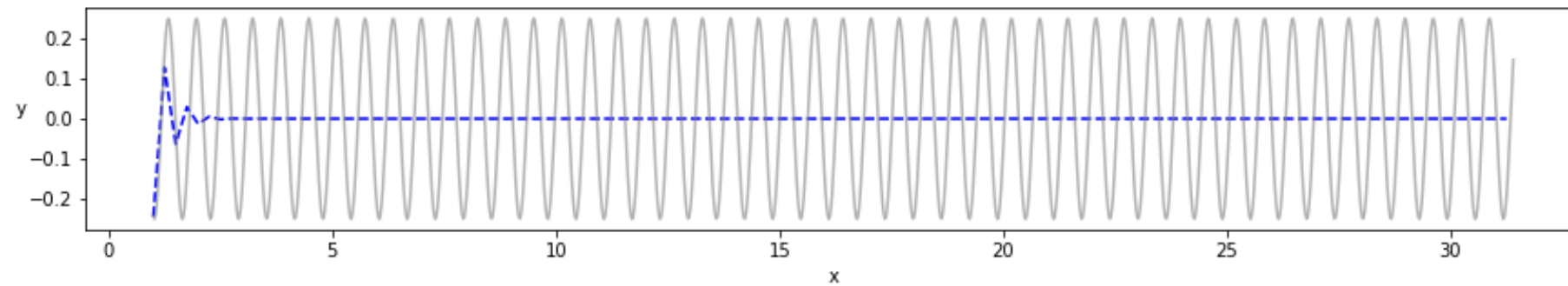
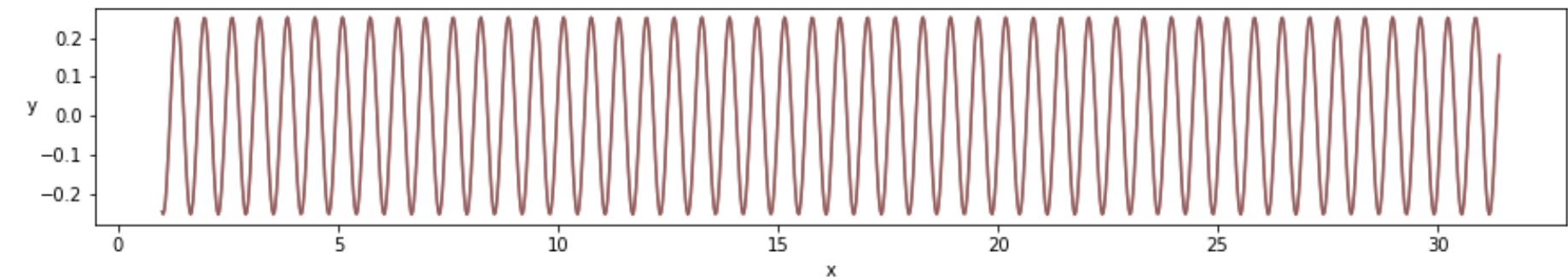
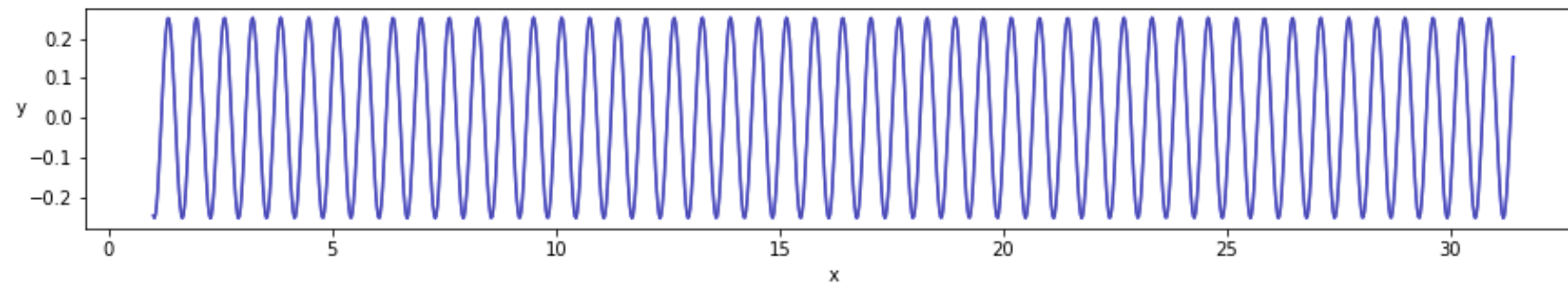


# Análises - RK4 e RK6





# Análises - RK4 e RK6





# Análises - Variação do 'h'



# Melhorias

- Outras conversões
- Gerar CSV
- Refinado o código
- Generalizado o APP

**Obrigado pela  
atenção!**