جلسه حل تمرین:

تمرین اول)

$$f = ax^n + bx^{n-1} + \dots + e$$

$$c = \frac{x_{min} + x_{max}}{2}$$
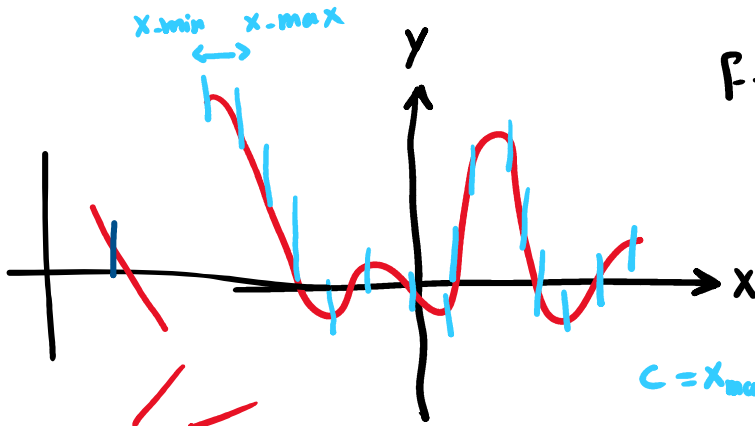
x_{min} x_{max}

$c = x_{max}$ ← $f_{(c)} * f_{(x_{min})} < 0$ if   در این بازه ریشه دارد

و

عدد کوچک

$-0.1 \leq f_{(c)} \leq 0.1$ یا $f_{(c)} = 0$ ⟸ $f_{(x_{max})} * f_{(c)} < 0$ if ↓ $c = x_{min}$ در این بازه ریشه دارد

تمرین دوم)

$$\dot{f}_{(t)} = \frac{f_{(t+dt)} - f_{(t)}}{dt} \longrightarrow v_x = \frac{x_{(t+dt)} - x_{(t)}}{dt}$$

$$\ddot{f}_{(t)} = \frac{f_{(t+dt)} - 2f_{(t)} + f_{(t-dt)}}{dt^2} \rightarrow a_y = g = \frac{y_{(t+dt)} - 2y_{(t)} + y_{(t-dt)}}{dt^2}$$

$$v_{oy} = \frac{Rg}{2v_{ox}} \rightarrow R = max(x)$$

تمرین سوم)

$$\frac{dy}{dt} = v_y$$ | $$\frac{dx}{dt} = v_x$$

$$y_{i+1} = y_i + v_{y_i} * delta\_t$$ | $$x_{i+1} = x_i + v_{x_i} * delta\_t$$

$$y_{i+1} = y_i + v_{y_i} * delta\_t \qquad x_{i+1} = x_i + v_{x_i}\bar{\ } delta\_t$$

$$\frac{dv_y}{dt} = a_y \qquad \frac{dv_x}{dt} = a_x$$

$$v_{y_{i+1}} = v_{y_i} + a_{y_i} \qquad v_{x_{i+1}} = v_{x_i} + a_x$$

$$F = -\alpha v^2 \rightarrow a'_y = \frac{F_y}{m} \qquad F = -\alpha v^2 \rightarrow a_x = \frac{F}{m}$$

$$\Rightarrow a'_y = -\frac{\alpha v v_y}{m} \qquad \Rightarrow a_x = -\frac{\alpha v v_x}{m}$$

$$\Rightarrow a_y = -g - \frac{\alpha v v_y}{m}$$

$$v_{y_{i+1}} = v_{y_i} + \left(-g - \frac{\alpha v_i v_{y_i}}{m}\right) * delta\_t \qquad v_{x_{i+1}} = v_{x_i} + \left(\frac{-\alpha v_i v_{x_i}}{m}\right)^* delta\_t$$

۰ نتیجه الگوریتم نهایی:

$$y_{i+1} = y_i + v_{y_i} * delta\_t \longrightarrow$$ باید به این صورت Euler تا اینجا

$$Euler(state, t, dt, derivative\_params)$$

$$x_{i+1} = x_i + v_{x_i} * delta\_t \longrightarrow$$ 〃

$$t = t + delta\_t$$

$$v_i = \sqrt{v_{x_i}^2 + v_{y_i}^2}$$

$$v_{x_{i+1}} = v_{x_i} + \left(-\frac{\alpha v_{x_i} v_i}{m}\right)^* delta\_t \longrightarrow$$ 〃

$$v_{y_{i+1}} = v_{y_i} + \left(\ldots - \frac{\alpha v_{y_i} v_i}{m}\right)^* delta\_t \longrightarrow$$ 〃

$$v_{y_{i+1}} = v_{y_i} + \left(-g - \frac{\alpha v_{y_i} v_i}{m}\right)^* delta\_t \rightarrow \quad ''$$