```
import numpy as np
import matplotlib.pyplot as plt
#condições iniciais
x1=80
y0=5
v0=120/3.6
g=9.88

#funcoes
def t(y0,funcao_theta,der_ctr,a,tol):
  t = (1/g)*(v0*np.sin(zeros_newton(funcao_theta,der_ctr,a,tol))+np.sqrt((v0**2)*(np.si
  return t
def x(theta,t):
  x_ = v0*np.cos(theta)*t
  return x_
def y(theta,t):
  y_ = y0+v0*np.sin(theta)*t-1/2*(g*t**2)
  return y_
def funcao_theta(theta):
  fTheta = x1-(v0*np.cos(theta))/g*(v0*np.sin(theta)+np.sqrt((v0**2)*(np.sin(theta)**2)
  return fTheta
def der_ctr(funcao_theta,x1,delx):
  fLinha = (funcao_theta(x1+delx)-funcao_theta(x1-delx))/(2*delx)
  return fLinha
def zeros_newton(funcao_theta,der_ctr,a,tol):
  while abs(funcao_theta(a)) > abs(tol):
    b = a - (funcao_theta(a)/der_ctr(funcao_theta,a,1e-8))
    a = b
  return a

#resultados
theta_1 = zeros_newton(funcao_theta,der_ctr,0,1e-10)
theta_2 = zeros_newton(funcao_theta,der_ctr,1,1e-10)
t_1 = t(y0,funcao_theta,der_ctr,0,1e-10)
t_2 = t(y0,funcao_theta,der_ctr,1,1e-10)
x_1 = x(theta_1,np.arange(0,t_1,0.1))
x_2 = x(theta_2,np.arange(0,t_2,0.1))
y_1 = y(theta_1,np.arange(0,t_1,0.1))
y_2 = y(theta_2,np.arange(0,t_2,0.1))
print(f'\nResultados:\nθ1={theta_1:.2f},\nθ2={theta_2:.2f}\nt1:{t_1:.2f}\nt2:{t_2:.2f}\

#grafico_zeros
plt.title('Zeros da Função')
array_x = np.arange(0,np.pi/2,0.01)
plt.plot(array_x,funcao_theta(array_x))
plt.plot(array_x,0*array_x)
plt.text(theta_1,0,f' θ1 = {theta_1:.2f}')
plt.text(theta_2,0,f' θ2 = {theta_2:.2f}')
plt.grid()
plt.show()

print('\n')

#grafico_trajetorias
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```
55 plt.plot(x_1,y_1)
56 plt.plot(x_2,y_2)
57 plt.title('Trajetórias')
58 plt.legend([f'θ1 = {theta_1*(180/np.pi):.2f}°',f'θ2 = {theta_2*(180/np.pi):.2f}°'])
59 plt.xlabel('Distância x(t)')
60 plt.ylabel('Altura y(t)')
61 plt.text(33,50,f't = {t_1:.2f}s')
62 plt.text(33,12,f't = {t_2:.2f}s')
63 plt.grid()
64 plt.show()
65
```

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Resultados:
θ1=0.32,
θ2=1.19
t1:2.53
t2:6.42
```

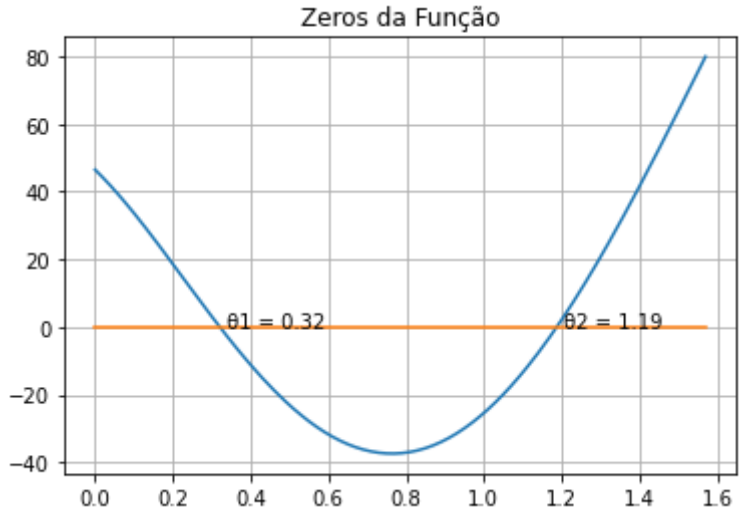

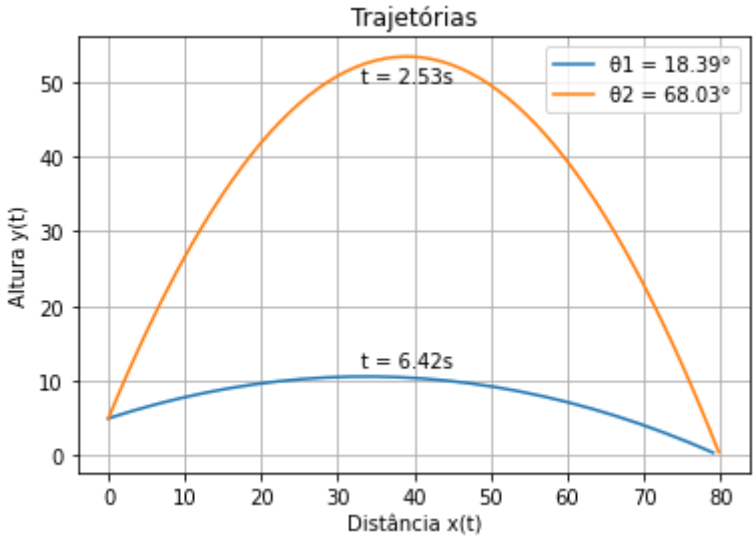

✓ 0s conclusão: 03:34