**Pendulum**

a) For a pendulum with given physical parameters $m$, $l$, $g$, write down the equations of motion and an expression for the exergy $E$. Explain the normalization procedure to get $\dot{\varphi} = p$, $\dot{p} = -\sin\varphi$. What are the "units" of time, energy and angular momentum in this normalized form?

b) In `pendulum.py`, the normalized equations are integrated using the forward-Euler method. Compare the behavior for different time steps $\Delta t$.

c) Implement alternative methods and investigate the behavior for different $\Delta t$ again:

   i) the 4th order Runge-Kutta method.

   ii) the trapezoidal rule.
   Hint: To get an easy implementation, introduce $\varphi^\star := \varphi_n + \frac{\Delta t}{2} p_n$ and
   $p^\star := p_n - \frac{\Delta t}{2} \sin\varphi_n$. Plug this into the discretized equations of motion to get a single transcendent equation for $p_{n+1}$. Then, solve that in a separate function `solvePendel` by means of Newton-Raphson iteration.

   iii) the drift-kick / Leapfrog / Verlet method