

# Orbits Exercise

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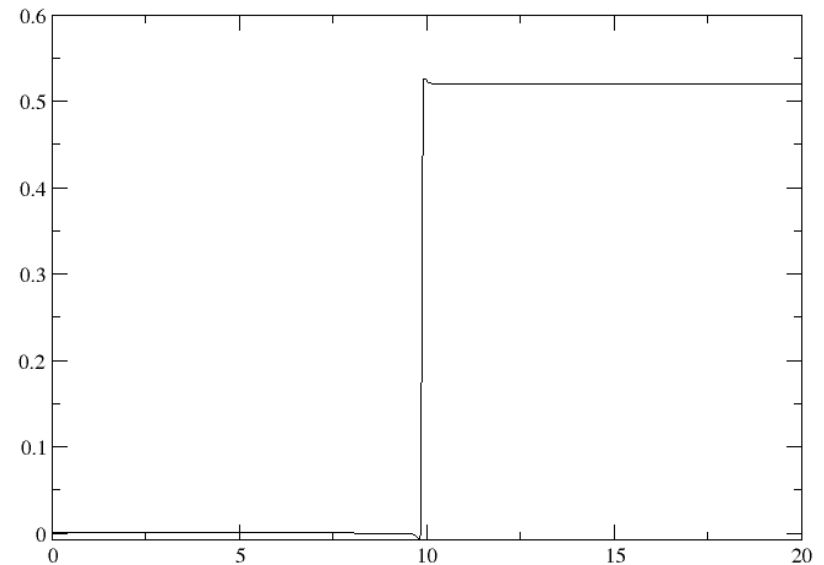
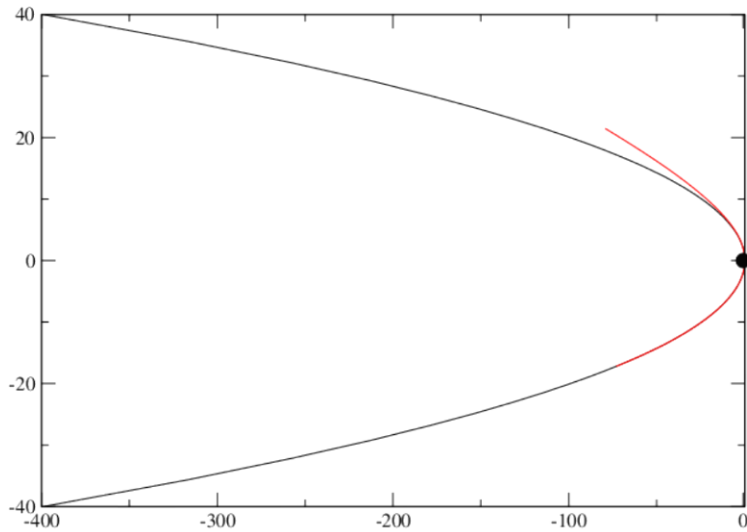
Solutions

EPSRC

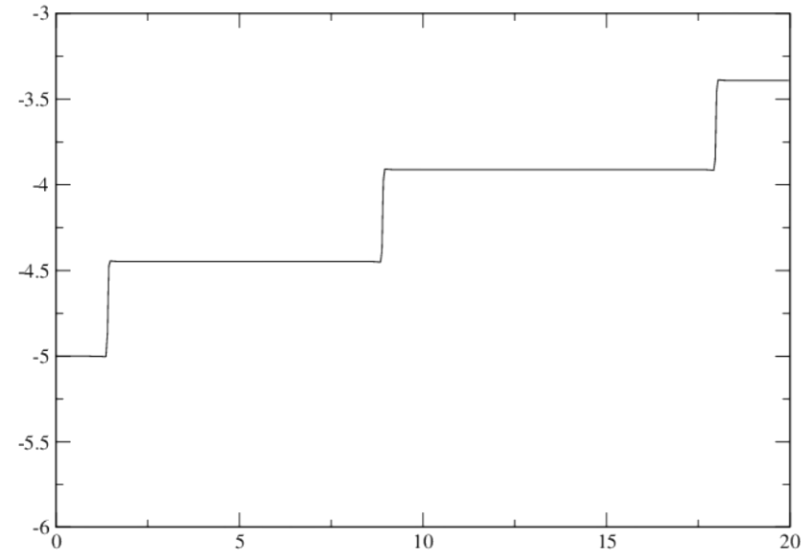
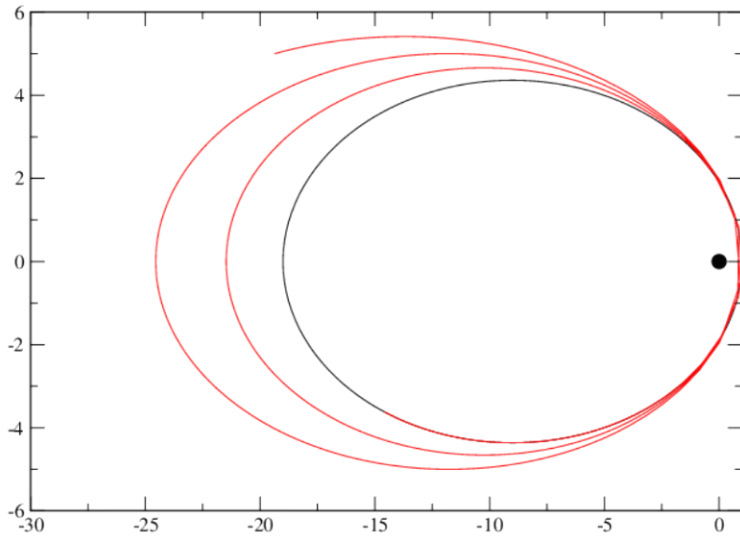
NERC SCIENCE OF THE ENVIRONMENT



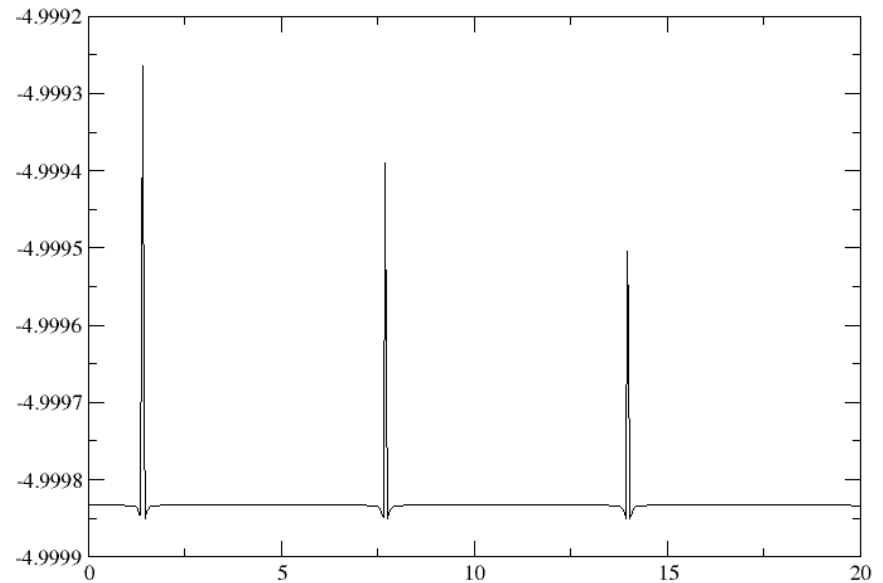
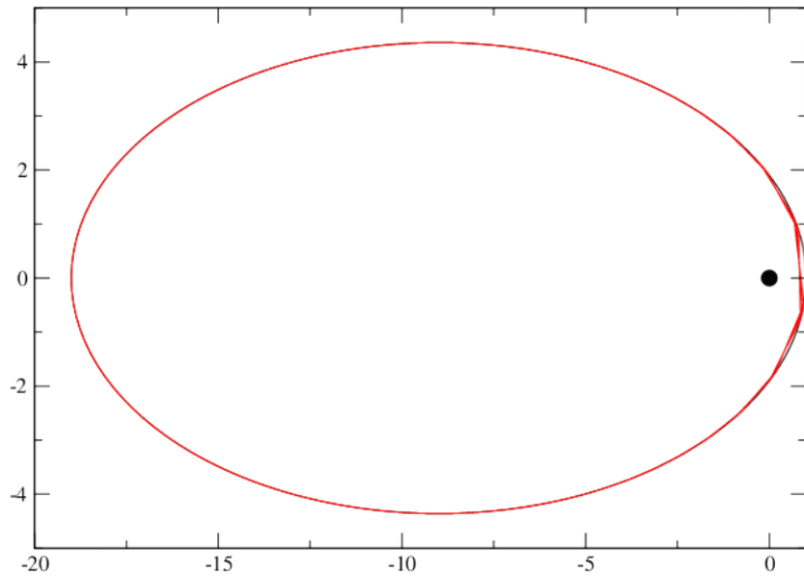
# Euler scheme: trajectory and energy



# Euler scheme: trajectory and energy



# Leapfrog scheme: trajectory and energy



# Summary

- Reducing truncation errors is very important
- Requires changing the algorithm
  - Euler: error is proportional to  $\Delta t$
  - Leapfrog: error is proportional to  $\Delta t^2$
- If  $\Delta t = 0.01$  and error in energy is 10 with Euler algorithm, how much work to reduce error to 0.1?
  - same algorithm:  $\Delta t = 0.0001$  and **100 times** the computational cost
  - Leapfrog algorithm:  $\Delta t = 0.01$  and **roughly the same** computational cost

