

Additional problems

Problem set 7c

For the following, submit spreadsheets and graphs (as a pdf file) via email. If you wrote code, email the code, graphs and tabulated results.

7. Consider the differential equation

$$\frac{dy}{dx} = \frac{x^3}{2} - 3$$

with $y(0) = 0$.

- (a) Use Euler's method to find $y(x)$ for $0 < x < 5$. Start with time steps of 0.5s, 0.2s, 0.1s, 0.05s, 0.02s, 0.01, ... until you find convergence (and agreement with the exact solution).
 - (b) Use the improved Euler method. Start with time steps of 0.5s, 0.2s, 0.1s, 0.05s, 0.02s, ... until you find convergence (and agreement with the exact solution).
8. Consider a spherical particle subject to gravity and air resistance:

$$m \frac{dv}{dt} = mg - kv^2$$

where the mass $m = 10^{-2}$, $g = 9.8 \text{ m/s}^2$ and the drag coefficient $k = 10^{-4} \text{ kg/m}$. The sphere is released from rest.

Determine the velocity of the sphere as a function of time $v(t)$ for $0 < t < 10 \text{ s}$. Use the improved Euler method. Try to find convergence for small time steps.