PHYS2502 Mathematical Physics Lab #5 20 Feb 2022

This lab assignment is at 8am, the morning after the date shown, although you should able to complete it easily before the end of the lab period. When you're done, upload your code to the github *repository, and a PDF of your output to the* canvas *page for the course.*

This lab involves the numerical solution for a differential equation. You can use NDSolve in MATHEMATICA to solve it, or anything else you've learned in your computing classes.

An object of mass $m = 1$ located at $x(t)$ is acted on by a force

$$f(x) = 50\, x\, e^{-25x^2/2} - e^{2x}$$

Find and plot the motion $x(t)$ if the mass starts from rest at the initial positions

1. $x_0 = 0.5$
2. $x_0 = 0.022$
3. $x_0 = 0.020$

You should find that these three motions are clearly very different from each other. (In fact, you might want to reduce the upper time limit for the third case.)

What's going on here, physically? It will probably help you understand the physics if you calculate and plot the potential energy function

$$U(x) = -\int f(x)\, dx$$