Assignment 5
Due Monday Mar 29

1. Solve the diffusion equation

$$\frac{\partial n}{\partial t} = D\frac{\partial^2 n}{\partial x^2}$$

numerically. Take:

- $D = 1$
- $\Delta x = 0.2$
- (1) $\Delta t = 0.02$ and (2) $\Delta t = 0.0266$
- $x_{\text{xmin}} = -20$ and $x_{\text{max}} = 20$
- $N_L = N_R = 0$
- $n(0, x) = e^{-x^2}$

(a) (125 points) Use the FTCS scheme we derived in class. Run for enough timesteps to see the solution evolve. In the case $r > 0.5$, when does the solution go unstable? Plot your results for both values of Δt

(b) (175 points) Use the Crank-Nicholson scheme we derived in class. Run for enough timesteps to see the solution evolve. In the case $r > 0.5$, does the solution go unstable? Plot your results for both values of Δt. Can you find any value of Δt that drives the solution unstable?