Name_____

PHYSICS 305 – Quiz 2 (redo) – Due: Nov. 4, 2024

1. (8 Points) A single particle in a fluid is undergoing thermal fluctuations in 3 dimensions. One of the code snippets below gives an iteration algorithm for the Langevin dynamics of the particle and the other is the Brownian dynamics iteration. Tell which snippet corresponds to each scenario and determine the ODE (or ODEs) that are being solved. Explain your reasoning.

A.
```
v[:,i] = v[:,i-1] + dt*(c*np.random.randn(3) – zeta*v[:,i-1]/2 )/(1 + zeta*dt/2)
x[:,i] = x[:,i-1] + (dt/2)*( v[:,i-1] + v[:,i] )
```

B.
```
x[:,i] = x[:,i-1] + c*dt*np.random.randn(3)/zeta
```

2. (12 Points) You want to solve the following equation using forward Euler:

$$\frac{\partial C}{\partial t} = 5\frac{\partial C}{\partial x} - \frac{1}{2}C$$

with boundary conditions

$$C\big|_{x=L} = 2$$

A. To approximate the spatial derivative, should you use forward difference, backward difference, or central difference derivatives? Explain why.
B. Why is there only one boundary condition?
C. Write out an iteration algorithm for the last two nodes (the N-2 and N-1 nodes)