5.

b) See code on class github under HW2_solns/q5_spring_model

c) See code on class github under HW2_solns/q5_spring_model

d) The Euler and A-B schemes have similar performances for both time steps. However, with the longer time step of 6 s, they appear to be phase-shifted compared to the analytical solution. This problem grows progressively worse as the simulation continues. Let's examine the period of the spring to determine why:

$$\tau = 2\pi * \sqrt{(m / k)}$$

For the conditions in the problem, the spring period is 28.1 s. With a time step of 1 s, the model can easily capture an entire period of the spring. However, for a 6 second time step, there are no longer at least 5 data points within a full oscillation and so the model does not properly capture the spring's motion. Thus, the model solution begins to drift from the analytical solution.