Problem Set 10 Solutions

1. Here are some plots:

Method A, \( a=0.1, b=1.0, w_1=2^{1/2}, w_2=2e, \tau=5 \)

Method B, \( a=0.1, b=1.0, w_1=2^{1/2}, w_2=2e \)

Figure 1: Here the ratio of the frequencies is irrational. We get a torus using both methods. Although the time series never repeats itself, this is not a chaotic system because it is not sensitive to initial conditions.
Figure 2: Now instead of a torus we get a line twisted around itself. It circulates around the torus faster than the small corrections are happening, so there are many twists before it repeats itself.
Figure 3: The same system is integrated for longer, and it doesn’t change the phase space picture because the system is periodic.
Method A, $a=3.0$, $b=0.1$, $w_1=1.5$, $w_2=6$, $\tau=5$, $T=80$

Method B, $a=3.0$, $b=0.1$, $w_1=1.5$, $w_2=6$, $T=80$

Figure 4: The small correction has a shorter timescale than the main oscillation. All the corrections have already happened after one revolution, so the line doesn’t twist back onto itself.