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APM147
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# Problem Set 10 Solutions

1. Here are some plots:

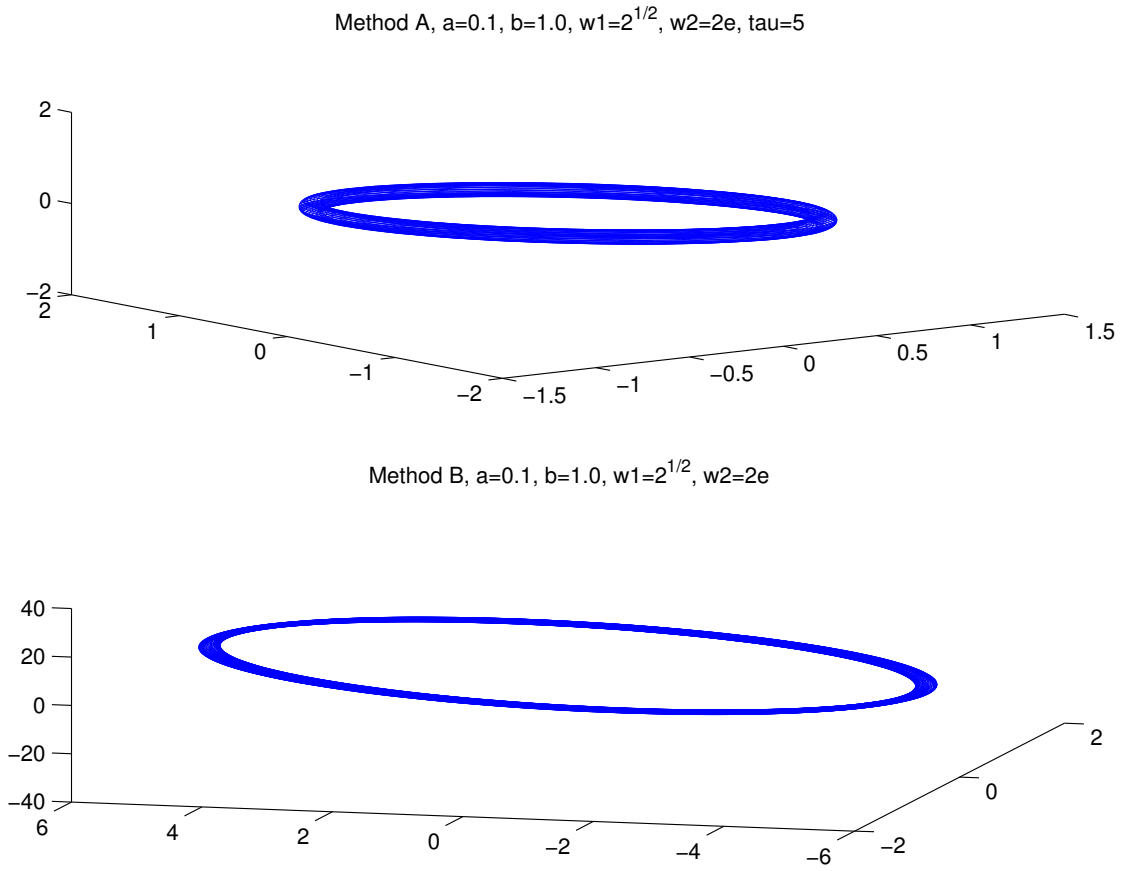


Figure 1: Here the ratio of the frequencies is irrational. We get a torus using both methods. Although the time series never repeats itself, this is not a chaotic system because it is not sensitive to initial conditions.

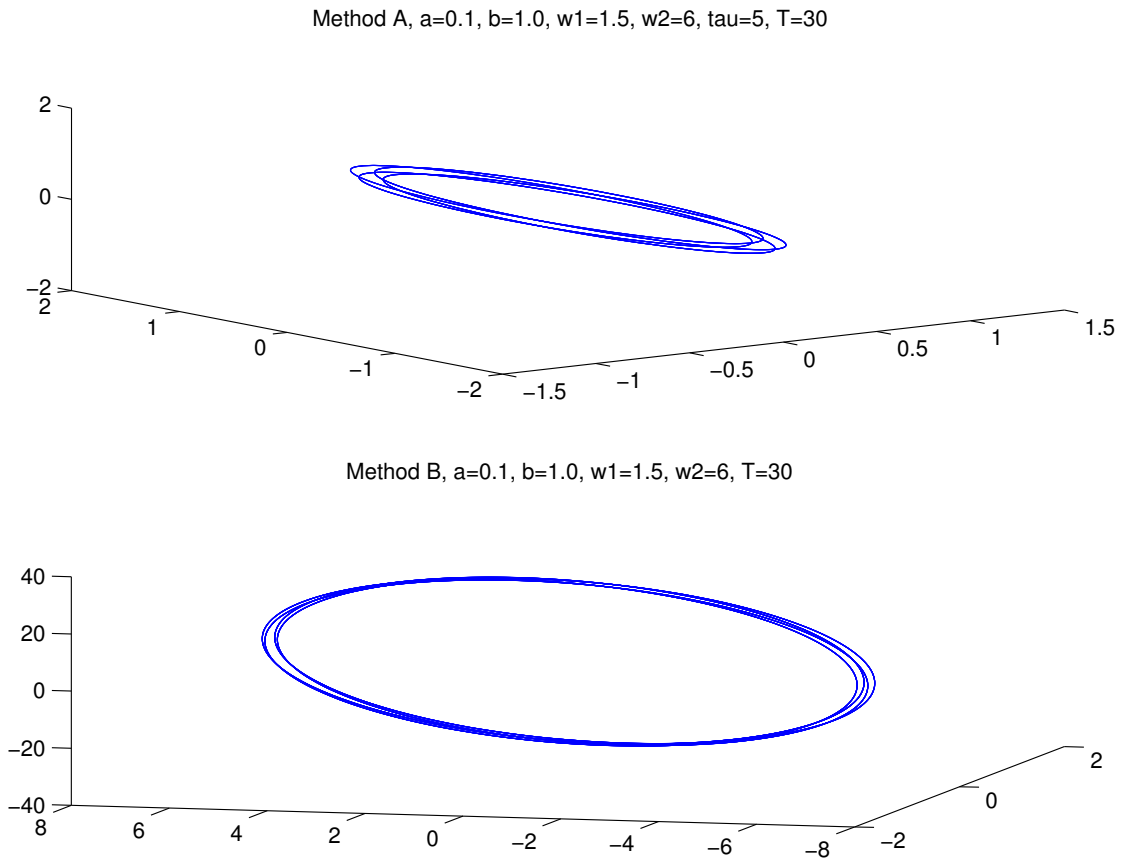


Figure 2: Now instead of a torus we get a line twisted around itself. It circulates around the torus faster than the small corrections are happening, so there are many twists before it repeats itself.

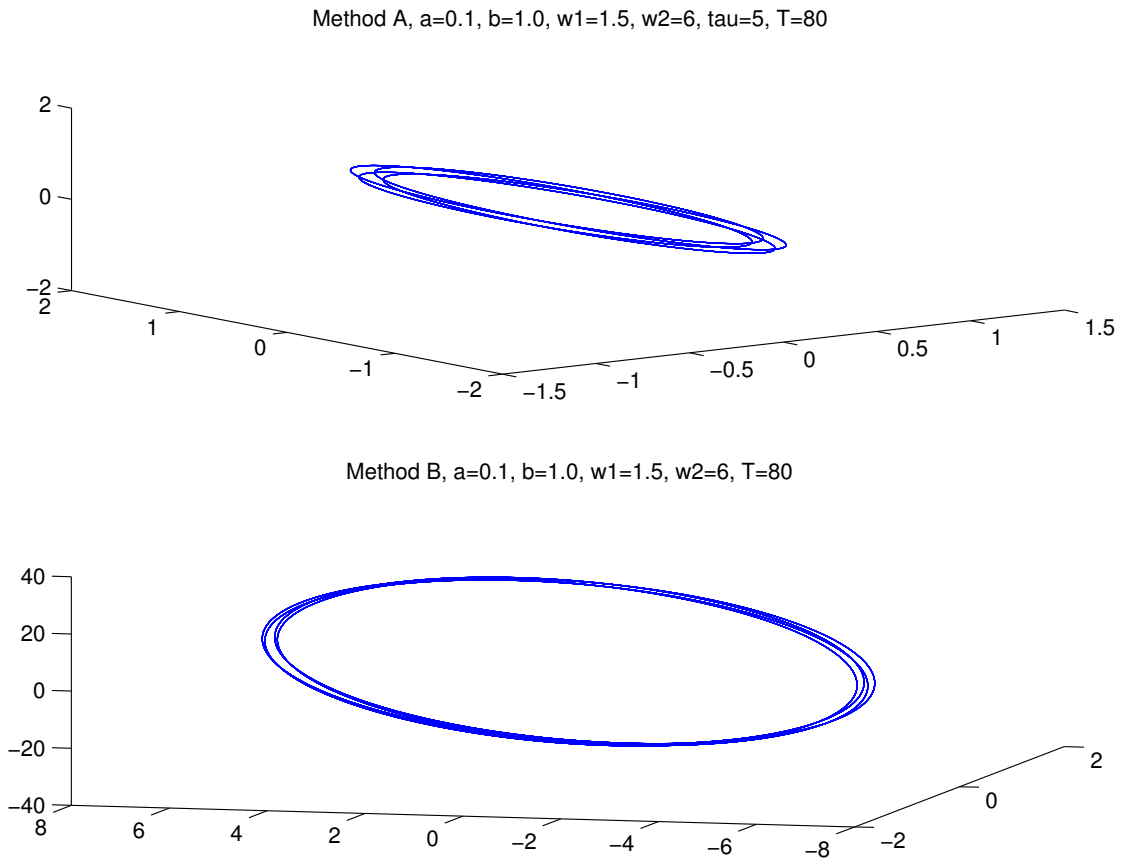


Figure 3: The same system is integrated for longer, and it doesn't change the phase space picture because the system is periodic.

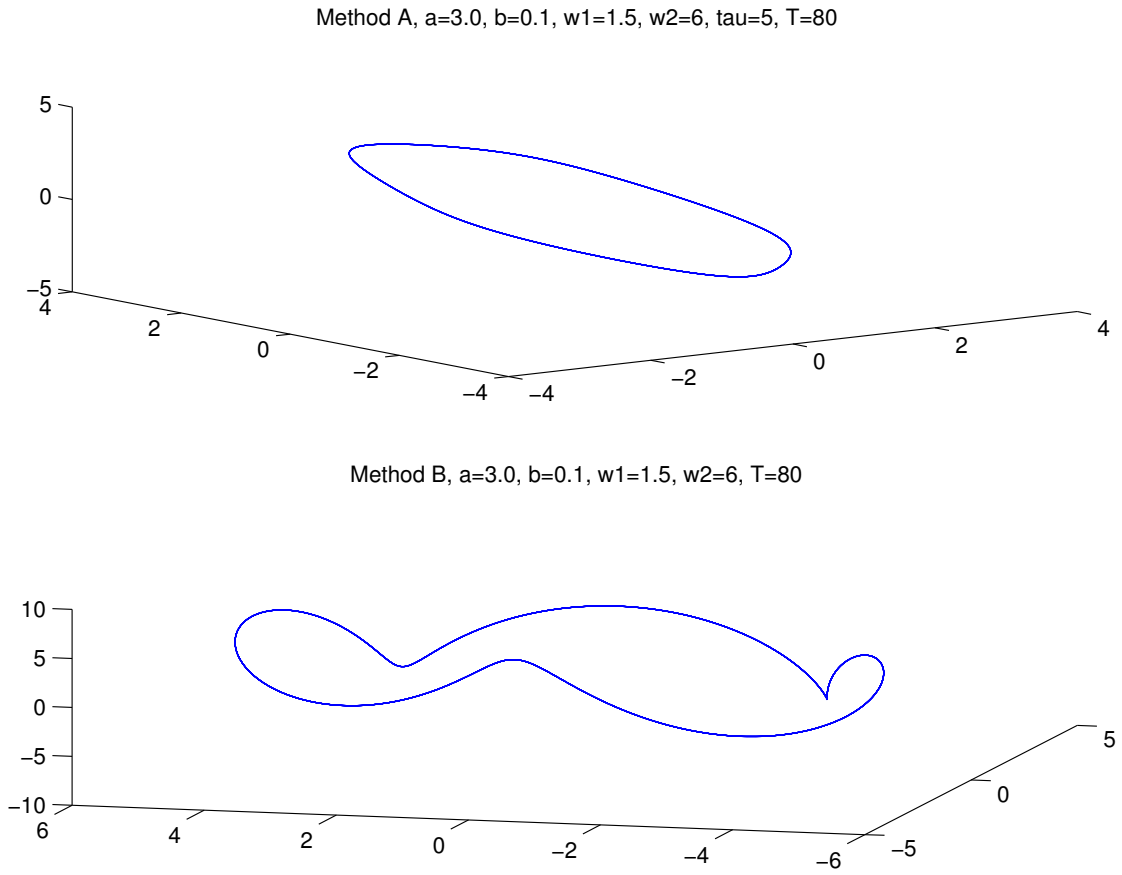


Figure 4: The small correction has a shorter timescale than the main oscillation. All the corrections have already happened after one revolution, so the line doesn't twist back onto itself.