Section 7.4 Learning Objectives:

- Video 1: Variable Amplitude and Midline (3:56)
  - Understand how a variable amplitude impacts the shape of a sinusoidal function.
  - Understand how a variable midline impacts the shape of a sinusoidal function.
- Video 2: Population Models (9:00)
  - Apply variable midlines to model populations with seasonal variation and an underlying linear or exponential growth.
- Video 3: Damped Harmonic Oscillation (9:59)
  - Apply variable amplitudes to model damped harmonic oscillation.

Individual Learning Objective Binder Check: Before class, you should have completed the Learning Objective Worksheet for each of the learning objectives in the video. These should have been placed in a binder in an organized manner so that it can be quickly checked by the instructor. If you have specific questions, this is a good time to ask the professor about them. While you are waiting for the professor to make their way around the room, you can work on the rest of the activities.

Group Practice Problems: In a group of no more than 3 students, work on the following problems. While everyone in the group should work together, each student should write out their work for themselves. This work can prove to be helpful when working on the homework assignment. If questions arise as you're working on these problems, feel free to seek help from the instructor or other groups of students.

Group Practice Problems #1 - Changing Midlines and Amplitudes: Sketch the graph. Clearly indicate the midline and amplitude.

- $y = \sin(\pi t) + (t + 1)$
- $y = e^t \cos(t)$

Group Practice Problems #2 - Population Models: Solve the word problems.

- A population of elk currently averages 2000 elk, and that average has been growing by 4% per year. Due to seasonal fluctuations, the population oscillates from 50 below average in the winter up to 50 above average in the summer. Find a function that models the number of elk after t years, starting in the winter.
- A population of fish oscillates 30 above and below average during the year, reaching the lowest value in January. The average population starts at 1000 fish and increases by 20 per month. Find a function that models the population P in terms of the months since January t.

Group Practice Problems #3 - Damped Harmonic Oscillation: Solve the word problems.

- A spring is attached to the ceiling and pulled 5 cm down from equilibrium and released. The amplitude decreases by 7% each second. The spring oscillates once every 2 seconds. Find a function that models the distance D the end of the spring is below equilibrium in terms of the seconds t since the spring was released.
- A spring is attached to the ceiling and pulled 15 cm down from equilibrium and released. After 4 seconds the amplitude has decreased to 10 cm. The spring oscillates 3 times per second. Find a function that models the distance D that the end of the spring is below equilibrium in terms of the seconds t since the spring was released.

Group Work Check: Present your work for the practice problems to the instructor for approval. The work will not be graded deeply, but simply graded on whether it appears that you have put in a good faith effort to do the work. If you are not confident about particular problems, this is a good time to ask about them.

Section 7.4 Homework:

- 7.4 (General Problems): #1 (Plot the points and sketch a potential curve), 3, 5, 7, 9, 11
- 7.4 (Write-Up): #6, 10