Each problem is worth 10 points, for a total of 120 points. Be sure to answer all parts of all the problems, even though I don’t necessarily give the answers below to all parts.

Reminder, the first midterm exam will be held January 22. It will cover the same subject material encompassed by the first two homework assignments, that is up through Monday, January 13 in the syllabus.

1. Questions 12 and 14 of Chapter 19. Violin strings and sound traveling from air into water.
2. Exercise 16 of Chapter 19. Speed of transverse waves. (41.8 m/s, 34.9 m, 1.70 Hz)
3. Exercise 26 of Chapter 19. Speed of sound waves. (24 m/s)
4. Exercise 28 of Chapter 19. Power in a transverse wave. (0.22 W)
5. Problem 39 of Chapter 19. Wave equation. In part (a) explain in terms of a picture of a wave pulse described by a function $f$ and consider how the peak of the pulse, for example, must move as $t$ increases.
6. Questions 4 and 5 of Chapter 20. Octaves and playing harmonics on a violin. Note that for question 5 the word “lightly” is important—the string is not held against the fingerboard in this situation.
8. Exercise 4 of Chapter 20. Substituting a standing wave into the wave equation.
10. Exercise 8 of Chapter 20. Normal modes on a string. (408 Hz)
12. Problem 37 of Chapter 20. Speed of sound in a tube. (375 m/s, $\gamma=1.39$) Note that from the beginning you should not assume that the displacement antinode is right at the end of the tube—you must consider differences in length between successive resonances.