1)

Inject the trial solution $p(x,t) = p_0 e^{i(kx-\omega t)}$ into the source-free 1D acoustic wave equation $\partial_t^2 p = c^2 \partial_x^2 p$. Discuss the solution.
Show that $p(x,t) = f(x-ct) + f(x+ct)$ is a general solution to the wave equation $\partial_t^2 p = c^2 \partial_x^2 p$. Discuss the result.

2) Show that $\Phi(r,t) = \frac{1}{r} f(r \pm \alpha t)$, where α is the wave velocity, is a solution to the 1-D wave equation in spherically symmetric media:

$$\frac{1}{r^2}\partial_r\left[r^2\partial_r\phi\right] - \frac{1}{\alpha^2}\partial_t^2\Phi = 0$$

3) Express the vp/vs ratio as a function of Poisson's ratio defined as: $\sigma = \frac{\lambda}{2(\lambda+\mu)}$.
Calculate the vp/vs ratio for σ=0.3.

4) Got to seismo-live -> Computational Seismology -> Wave propagation -> Acoustic Green's function
   - Run the program and investigate the results
   - What is the meaning of the Green's function?
   - Discuss the results in 1D, 2D, and 3D, what are the implications?
   - Explain the concept of the convolution theorem in connection with Green's functions and the wave equation

5) Computational seismology: You want to simulate wave propagation on a discrete regular grid with physical dimensions $(1000\text{km})^3$ with a dominant period of 10s. The maximum velocity in the medium is 8km/s, the minimum 5km/s. Your numerical algorithm requires 20 points per dominant wavelength. How many grid points do you need? The so-called stability criterion (or Courant criterion) is const=c dt/dx where c is the maximum velocity and const=1. You want to simulate 500s. Determine dt and the number of required time steps for the simulation?