HW2.

1. In the simulation of a standing wave, why does vx have double wave vector of vy?
2. Experiment with the timestep dt in the code, what does dt/dx have to be for stability?
3. Put in an option for a Gaussian initial velocity (vpert\*exp( -((x(i)-0.5)/w0)^2 ):
4. Why there are left and right going packets?
5. If the perturbation velocity is only in the x direction (vx), show that you get the sound wave solution with the correct sound speed (omega/k = V\_sound);
6. How does the choice of w0 affect the conservation of energy? Why?
7. Put in a hard-wall perfect conductor boundary condition, simulate the motion of a traveling Alfvenic gaussian wave packet (vy perturbation only). Show that
8. you get the sound wave solution with the correct Alfvén speed;
9. the gaussian wave packet reflects off the boundary;
10. Energy is conserved.
11. Put in a constant By0 term in the equations, and simulate the fast mode wave (small amplitude vx sinoidal perturbation), show that you get the write wave period based on V\_fast^2 = V\_alfven^2 + V\_sound^2
12. What happens if you simulate the Alfvén wave (vy sinoidal perturbation) for a long time with beta = 0? why? Explain it quantitatively.
13. [Optional, extra credit 20%] Implement the one-step Adams-Bashforth time stepping method and simulate a traveling Alfvén wave packet.