Geophysics 4133
Seismic Reflection
J.R. Leeman

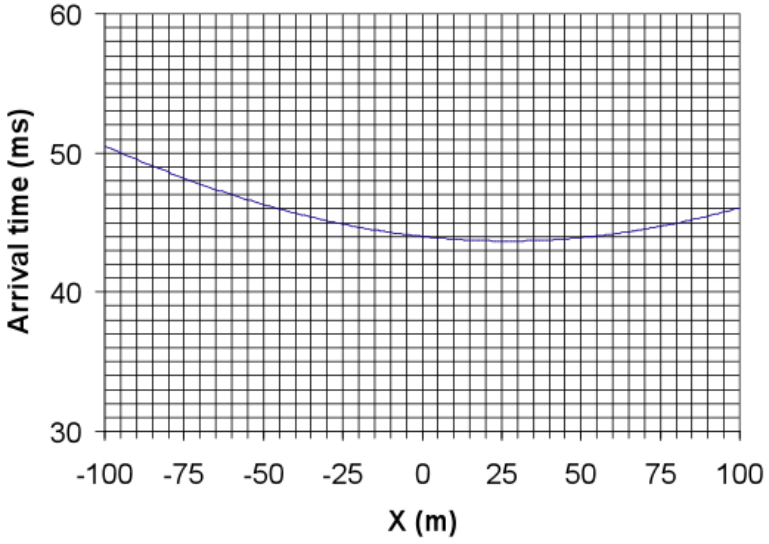
Name: _____

For each of the following problems neatly show all steps of your work (partial credit may be given if your work can be easily followed). Clearly indicate your final answers and answer all parts of the question including the 'describe' and 'why' questions.

1. Given the following interval velocities and thicknesses, calculate the average velocity and the RMS velocity down to the 1st, 2nd, and 3rd interface. *(15 pt.)*
   $V_1 = 2000$ m/s, $h_1 = 20$ m
   $V_2 = 3200$ m/s, $h_2 = 63$ m
   $V_3 = 3950$ m/s, $h_3 = 47$ m

2. A seismic reflection section shows a set of parallel horizontal reflectors at two way travel times of 1.00, 2.00, 3.00, and 4.00 sec. The time averaged velocities for these reflection times have been estimate from stacking velocities at each end of the section to be 2.50, 3.00, 3.50, and 4.00 km/sec, respectively. *(15 pt.)*
   a) Find the depth to each reflector and note the vertical compression of the seismic section due to the increase of velocity with depth.
   b) If the average velocity to the 2.00 sec reflector in the central part of the section is found to be only 2.90 km/sec, how much relief is actually present in this apparently flat reflector?

3. Interpret the seismic reflection data shown below. Data were collected using a split shot configuration with the shot located at x = 0. Since the data are not symmetrical about the x = 0, the reflector is dipping. Determine the dip, dip direction, reflector velocity, vertical and perpendicular depths to the reflector under the shot. *(20 pt.)*



Assume a subsurface geometry with one flat reflector *(50 pt.)*:

a) Sketch 10 seismic traces in a CMP gather.

b) Sketch these same traces after application of NMO corrections using the correct subsurface velocity.

c) What would happen if we corrected the NMO in these traces with the incorrect velocity, and then stacked the traces?

d) Sketch the resulting seismic trace(s) after stacking this CMP gather (assuming we use the correct subsurface velocity).

e) Why do we collect multiple data (multiple reflections) from the same subsurface point?