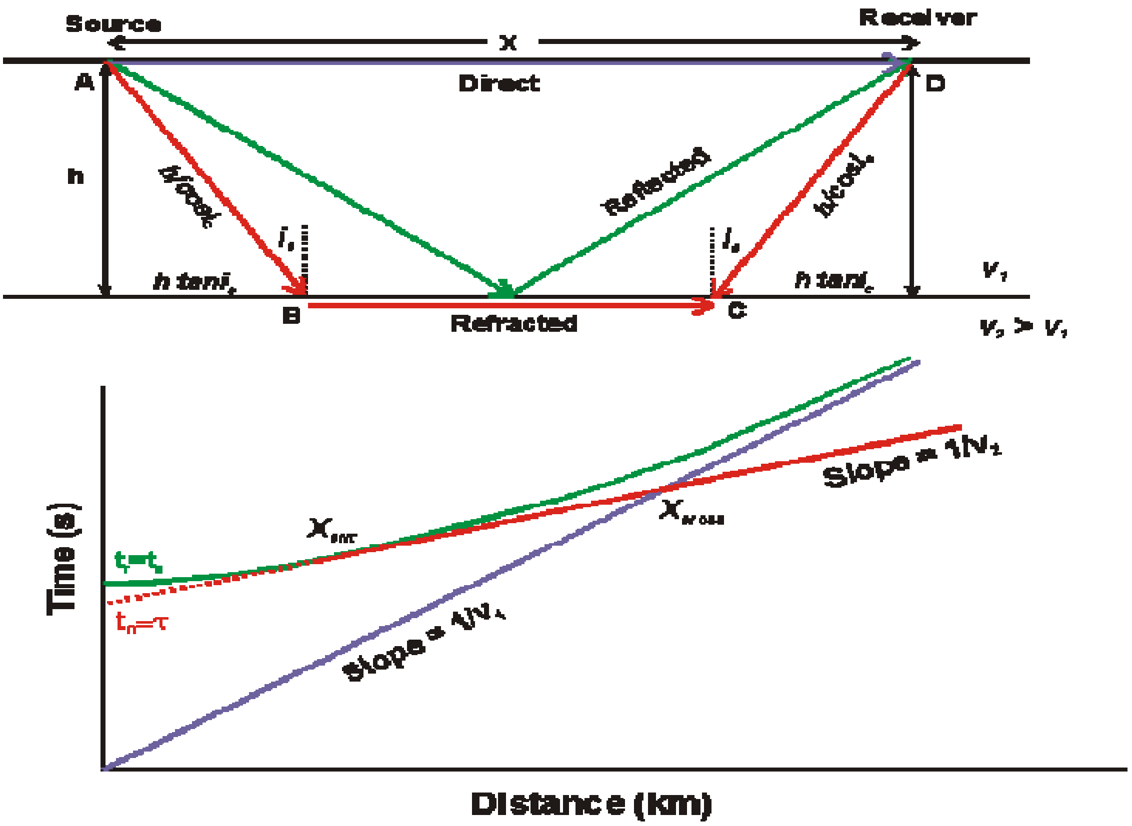
Exercise 1



We consider a simple two-layer model as shown in the figure above, where the P-wave velocity of layer *1* and *2* is v_1 and v_2 , respectively (note $v_2 > v_1$). In general, a receiver will measure three different wave contributions: direct wave, reflected wave and refracted wave.

(a) Find an expression for the traveltime to an arbitrary receiver for the *direct* wave in the first layer as a function of offset x (i.e. source-receiver distance).

(b) The *refracted* wave can only be received after the critical distance x_{crit}. Find an explicit expression for this distance.

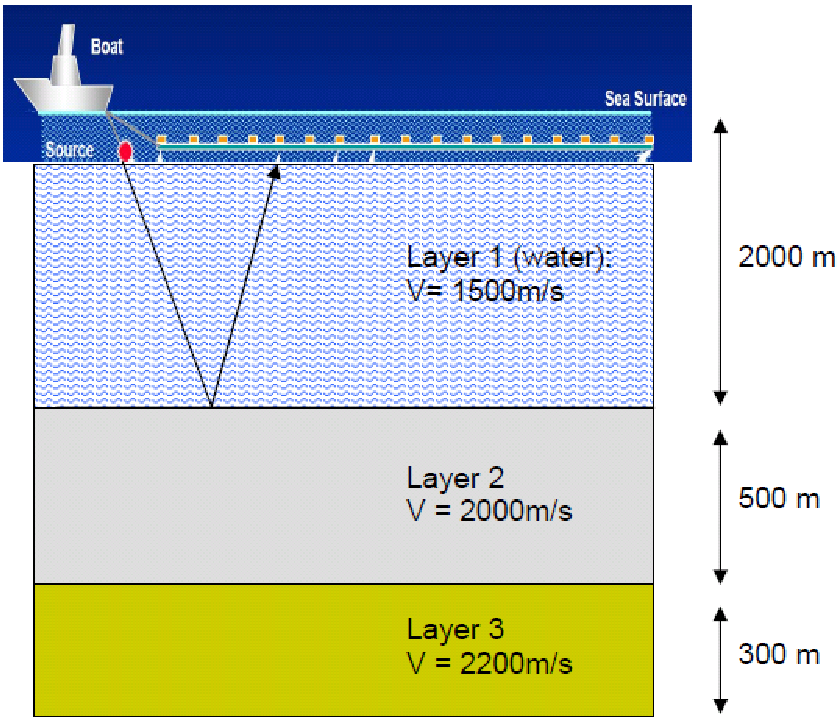
(c) The cross-over distance x_{cross} is the distance where the *refracted* wave starts to take over to be the first arrive at a point. Show that this distance can be written as:

$$x_{cross} = 2h\sqrt{\frac{v_1 + v_2}{v_2 - v_1}}$$

(d) Find an expression for the traveltime to an arbitrary receiver for the *reflected* wave for this 2-layer model.

Exercise 2

Consider a horizontally 3-layered earth model as shown in the figure and assume that 2D marine seismic data are acquired at the surface employing a streamer with 120 hydrophone groups (group interval Δg=25 m). Distance between shot and first hydrophone group is 100 m.



a) **Compute the zero-offset reflection coefficient at the seafloor if the density of layer 2 is set to 2.2 g/cm^3. Compute also the maximum *normal moveout* (i.e. the difference between maximum traveltime recorded and a zero-offset case) for the reflection events from the seafloor.**

b) **Determine the maximum incidence angle for reflections at the interface between layers 2 and 3.**