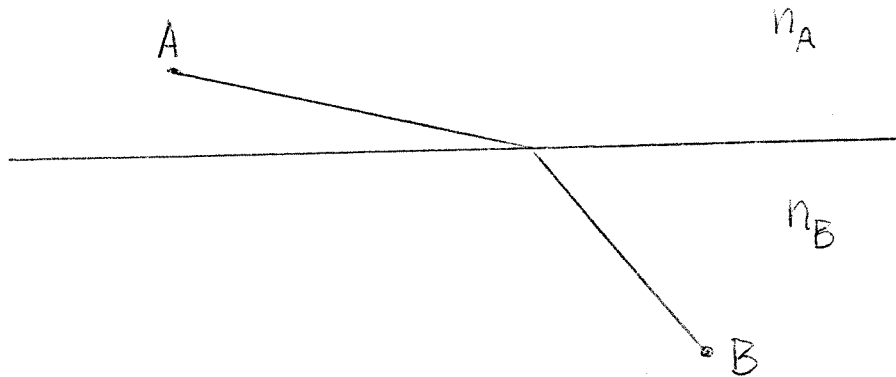


B2) Consider points A and B which lie on two sides of a plane boundary separating regions of uniform index of refraction n_A and n_B , as shown.



A light ray travels between A and B . The ray will consist of straight line segments in the two media, but the segments in regions n_A and n_B will travel in different directions owing to refraction at the interface.

- (5 points) Show that the actual path taken by the ray is the one that takes the least time for passage from A to B . The statement that light rays follow the path of least time of propagation is known as *Fermat's Principle*.
- (2 points) Write an expression for the time of transit between points A and B when the medium is inhomogeneous, and n is a differentiable function of position: $n(x, y, z)$. [You will need to parametrize the path in some way.]
- (3 points) Use Fermat's principle and your expression in b) to derive the differential equations that determine the trajectory of the light ray passing between two points, like A and B .