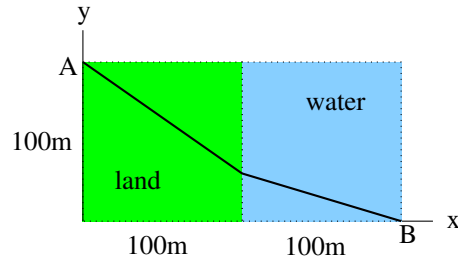


[mex29] Athletic refraction

An athlete starts at point A and wants to reach point B in the shortest possible time by running over land and swimming across water. Her running speed is $v_1 = 7\text{m/s}$ and her swimming speed $v_2 = 1\text{m/s}$. (a) At which point $(x, y) = (100\text{m}, ??)$ should she dive into the water along the optimal path and in what time does she finish the race? (b) Derive Snell's law, $\sin \theta_1 / \sin \theta_2 = v_1 / v_2$, from this extreme-value calculation and identify the angles θ_1, θ_2 in the illustration below.



Solution: