Problem 5

From a 2D video analysis of a long jump we get the position and times of the centre of mass of the athlete when taking off for the last step \( (P_1) \), making contact with the board \( (P_2) \), taking off from the board \( (P_3, t=0) \) and at the highest point during flight \( (P_4) \); body mass = 80kg.

a) Calculate the kinetic, potential and total energies at \( P_2, P_3, P_4 \) and the energy loss during take off.

b) Calculate the effective jump length.

\( P_1 = (-2.62, 0.94, -0.29) \), \( P_2 = (-0.28, 0.99, -0.03) \), \( P_3 = (0.11, 1.06, 0) \)

\( P_4 = (3.84, 1.54, 0.49) \); last number gives the time.