University of Heidelberg WS 07/08

1. Exercise Sheet for Theoretical Physics I (Mechanics)

To be handed in in the exercise groups of the 2nd week (24th October, 2007)

Exercise 5: (5 Points)

Little Konrad slides frictionlessly down a spiral slide at the swimming pool. The spiral has a radius r and three full circles a height h apart. Determine the trajectory $\mathbf{x}(t)$ in a convenient Catresian coordinate system. (*Hint:* Consider the spiral unwrapped onto an inclined plane and use energy conservation.)

Exercise 6: (5 Points)

a) The two front legs of a tripod are each 1.4 m long. Their feet are at a distance 0.8 m apart. The third leg is 1.5 m long and its foot is 1.5 m behind the center of the connecting line of the two front legs. Determine the height of the tripod and the three vectors that characterize the position of the feet relative to the tip.

b) Consider what happens if a 2 kg weight is placed on the tripod. Assuming pure compression along each leg, and neglecting the weight of the legs, calculate the force in each leg. (Assume the acceleration due to gravity to be $g = 10\,\mathrm{m/s^2}$).

Exercise 7: (5 Points)

A ball of mass m is thrown vertically upwards. It is subject to acceleration due to gravity is g and Newton friction proportional to the velocity squared, $|F_{\text{friction}}| = cv^2$ with $c = \text{const}$.

a) Determine the trajectory up to the highest point.

b) Compare the time t_1, in that the ball rises, to the time t_2, that it needs to fall back. Is $t_1 > t_2$, $t_1 < t_2$ or $t_1 = t_2$?