# Homework 8: Work and Mechanical Energy

**Due:** Tuesday November 20th, 16:00

**Policy:** Collaboration is allowed, but every student is required to hand in his/her own version of the solutions. Please include your name and student number on the solutions.

**Problem 1.** A particle with mass $m = 0.2$ kg moves under the influence of a conservative force $\vec{F}$. The components of the force with respect to a Cartesian coordinate system are:

$$F_x = 2\,p\,x^3 y^2,$$
$$F_y = x^q y,$$
$$F_z = 0.$$

The constants $p$ and $q$ are $\neq 0$.

1. Determine $p$ and $q$.

2. The particle passes the point $P = (1, 2, 0)$ with velocity $\vec{v} = 6\hat{j}$. Determine the magnitude of the component of the acceleration tangential to the trajectory and the curvature radius of the trajectory at that point.

3. Determine the potential energy of the particle at $P$ with respect to the origin.

**Problem 2.** (K. & K. 5.13)

A bead of mass $m$ slides without friction on a smooth rod along the $x$-axis. The rod is equidistant between two spheres of mass $M$. The spheres are located at $x = 0$, $y = \pm a$ as shown and attract the bead gravitationally.

1. Find the potential energy of the bead.

2. The bead is released at $x = 3a$ with velocity $v_i$, toward the origin. Find the speed as it passes the origin.