

2. (25 points) A particle of mass m moves in two dimensions (x, y) with potential energy of:

$$U(x, y) = \frac{1}{2}k_o(x^2 + y^2) + k_1x^2y - k_2y^3$$

where k_o, k_1 and k_2 are positive constants. For each of the following, express your answer in terms of position (x, y) and velocity (v_x, v_y) .

- a) What are the momenta p_x and p_y conjugate to coordinates x and y ?
- b) What is the classical Hamiltonian H for this system?
- c) What are Hamilton's equations of motion for this system?
- d) What conditions of k_o, k_1 and k_2 make this system analytically integrable?