

PHY820/422 HW #1 — Due Monday 9/11/17 @ 5pm

Fundamentals of Mechanics: Warm Up and Review

1. José and Saletan, Chapter 1, problem 5

Two masses m_1 and m_2 in a uniform gravitational field are connected by a spring of unstretched length h and spring constant k . The system is held by m_1 so that m_2 hangs down vertically, stretching the spring. At $t = 0$ both m_1 and m_2 are at rest, and m_1 is released, so that the system starts to fall. Set up a suitable coordinate system and describe the subsequent motion of m_1 and m_2 .

2. José and Saletan, Chapter 1, problem 7

Show that a one-dimensional particle subject to the force $F = -kx^{2n+1}$ where n is an integer, will oscillate with a period proportional to A^{-n} , where A is the amplitude. Pay special attention to the case of $n \leq 0$.

3. José and Saletan, Chapter 1, problem 15

A particle of mass m moves in one dimension under the influence of the force

$$F = -kx + \frac{a}{x^3}$$

Find the equilibrium points, show that they are stable, and calculate the frequencies of oscillation about them. Show that the frequencies are independent of energy.

4. José and Saletan, Chapter 1, problem 21

Draw the phase portrait for the system of Problem 15.