

Homework #11 Due April 15

- Read Sections 23, 35, 36, and 37 in Gelfand & Fomin.
 1. Problem #6 on p. 95 of Gelfand & Fomin.
 2. Problem # 7 on p. 95 of Gelfand & Fomin.
 3. Problem #8 on p. 95 of Gelfand & Fomin.
 4. Problem #9 on p. 95 of Gelfand & Fomin.
 5. Consider the functional with Lagrangian $F(u, p) = \frac{1}{2}(p + ku)^2$.
 - (a) Find the corresponding Hamiltonian.
 - (b) Solve the resulting Hamilton-Jacobi equation.
 - (c) Use the results of part (b) to find the extremals of the functional.
 6. Consider a particle with mass m in \mathbf{R}^3 moving under the influence of the potential V . Of course, the Lagrangian is

$$L(x, y, z, p, q, r) = \frac{m}{2} (p^2 + q^2 + r^2) - V(x, y, z).$$

- (a) Write the Lagrangian in polar coordinates r , θ , and ϕ , defined by $x = r \sin \phi \cos \theta$, $y = r \sin \phi \sin \theta$, and $z = r \cos \phi$.
- (b) What is the corresponding Hamiltonian?
- (c) Assuming that $V = -k/r$, reduce the solution of the Hamilton-Jacobi equation to the evaluation of integrals. (It is not necessary to evaluate the integrals.)

Final Exam The final exam will be made available on the last day of class, April 22, and it will be due on the last day of exams (which is different depending on whether or not you are a degree candidate). To help me write the exam, I would appreciate it if you would submit a problem or two that you think would be appropriate for the exam. I will distribute all such problems to the class as a whole. However, I will maintain my prerogative to use all, some, or none of them.

The deadline for submissions is Tuesday, April 15.

I assure you that there is no obligation on you to submit anything, and there will be no credit or discredit attached to any submission or lack thereof.