

HOMEWORK 5 , Due date 3/4 (you can always hand it in early!)

1. A particle of mass m moves in one dimension along the x -axis in the region where $x > 0$. It is acted on by two forces. F_1 is a constant force of magnitude B directed away from the origin of magnitude B . F_2 is a constant force of magnitude A/x^2 directed towards the origin. Find a) $U(x)$, b) the equilibrium position, and c) if this equilibrium position is stable or not.
2. A rocket of mass M ascends from rest from earth by ejecting material with a constant speed u , and a rate given by $dM/dt = -\gamma M$, where γ is a constant. There is air resistance, of magnitude Mbv , impeding its progress. Find $v(t)$. (Take gravitational acceleration as a constant, g).
(This question, though mathematically soluble, disturbs me on physics principles. A bonus point will be given to people who can tell you why I am disturbed!)
3. In a certain system, you guess that the energy, E of a sphere is dependent on its density (ρ), mass (m), distance from the origin (d), gravitational acceleration (g), and radius (r). Find three of these quantities with independent dimensions, and obtain an expression for E in terms of these quantities and a dimensionless term.