

1. A boat of mass m is impeded by the resistive force of the water. This resistive force has a magnitude of bv where $b > 0$. The boat is moving at v_0 when the engine is shut off.
Determine the velocity after some time has passed, $v(t)$.
2. A particle of mass m has speed $v(x) = \alpha/x$. Find the force $F(x)$ responsible.
3. For what values of a, b and c is the force $\vec{F} = (ax^2 + by^2)\hat{i} + cxy\hat{j}$ conservative?
Determine the potential energy associated with this force.
4. A car's suspension acts like a mass spring system with $m = 1200\text{kg}$ and $k = 58\text{kN/m}$. Its worn out shock absorbers provide a damping constant of $b = 230\text{kg/s}$. The car hits a pothole.
 - (a) Is this system underdamped, critically damped, or overdamped?
 - (b) What's the frequency of the oscillation?
 - (c) How many oscillations will it make before the amplitude drops to half its initial value?
 - (d) What's the quality factor of the system?
 - (e) What's the resonance frequency of this system?(Note: $b \neq \beta$.)