

19. Write down the equations of motion in polar co-ordinates for a particle of unit mass moving in a plane under a force with potential energy function $V = -k \ln r + cr + gr \cos \theta$, where k, c and g are positive constants. Find the positions of equilibrium (a) if $c > g$, and (b) if $c < g$. By considering the equations of motion near these points, determine whether the equilibrium is stable (*i.e.*, will the particle, if given a small displacement, tend to return repeatedly?).