

## Problem 20

Assume that the system described by the equation  $mu'' + \gamma u' + ku = 0$  is critically damped and that the initial conditions are  $u(0) = u_0$ ,  $u'(0) = v_0$ . If  $v_0 = 0$ , show that  $u \rightarrow 0$  as  $t \rightarrow \infty$  but that  $u$  is never zero. If  $u_0$  is positive, determine a condition on  $v_0$  that will ensure that the mass passes through its equilibrium position after it is released.