In order to receive full credit, SHOW ALL YOUR WORK. Full credit will be given only if all reasoning and work is provided. When applicable, please enclose your final answers in boxes.

1. (10 Points) Given,

$$my'' + ky = 0, \quad y(0) = 1, \ y'(0) = -1. \tag{1}$$

   (a) Convert the second-order ODE into a system of first order ODE's.

   (b) Using eigenvalues and eigenvectors, solve the corresponding initial value problem.

   (c) Classify the equilibrium point and sketch a possible phase portrait for the system.