1. Consider a system:
\[
\begin{align*}
\frac{dx}{dt} &= y \\
\frac{dy}{dt} &= -0.1x - 0.7y
\end{align*}
\]

a) Draw direction field for this system (in different color) (Use HPGSystemSolver to verify your work)

b) Convert the system to a 2nd order ODE.

c) Find two different solutions of the ODE by guess-and-test method.

d) Obtain two solutions of the system:
\[ Y_1(t) = \begin{pmatrix} x_1(t) \\ y_1(t) \end{pmatrix}, \quad Y_2(t) = \begin{pmatrix} x_2(t) \\ y_2(t) \end{pmatrix} \]

(remember that \( y(t) = \frac{dx}{dt} \))

Confirm that \( Y_1(t) \) and \( Y_2(t) \) are linearly independent

e) On a phase plane draw solution curves for solutions from d).

f) Find the general solution of the system and the solution of the system satisfying initial condition \( Y(0) = \begin{pmatrix} 2 \\ 2 \end{pmatrix} \).

g) Use HPGSystemSolver to draw the solution with \( Y(0) = \begin{pmatrix} 1 \\ 1 \end{pmatrix} \) on the phase plane.

2. Find the general solution to
\[
\frac{d^2y}{dt^2} + 16y = 0 \quad (\text{Hint: read pp. 250-252})
\]