atProblem 1.

Fill in the following table, specifying the dependent variable, the independent variable(s), the order of the differential equation and whether it is linear or non-linear and explain why. If the system is non-linear, **place a box around the term(s) making it non-linear**. All equations are in terms of a function of an independent variable.

SYSTEM	ORDER?	Dependent Variable	Independent Variable(s)	Autonomous or Non-Autonomous?	LINEAR OR NON-LINEAR? Circle any term(s) that make it non-linear.
$x^2y'' + xy' + y = \cos(x)$	2	y	x	Non	Linear
$y' + e^y = x$	1	y	x	Non	Nonlinear
$\dfrac{d^2y}{dt^2} = -t^2\frac{dy}{dt} + e^t$	2	y	t	Non	Linear
$\dfrac{d^3x}{dt^3} + x\dfrac{dx}{dt} = t\ln(x)$	3	x	t	Non	Nonlinear
$L\dfrac{d^2i}{dt^2} + R\dfrac{di}{dt} + \dfrac{i}{k} = E\sin(kt)$	2	i	t	Non	Linear

Problem 2 (Separation of Variables)

Find the IVP solution for the following differential equation by separation of variables:

a. $4tdy = (y^2 + ty^2)dt \qquad y(1) = 1$