MTH 302: Linear Algebra and Differential Equations

Activities for Linear, Homogeneous First Order Systems of Differential Equations (2023-03-14)

1. Find the general solution for the system:

$$\frac{dx}{dt} = x - 2y$$

$$\frac{dy}{dt} = -6x - 3y$$

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2. Try it again on the system

$$\frac{dx}{dt} = 3x + y$$

$$\frac{dy}{dt} = 3y$$

(a) What goes wrong?

(b) Verify by direct substitution that the following function solves the system:

$$\mathbf{x}(t) = te^{3t}\begin{bmatrix}1\\0\end{bmatrix} + e^{3t}\begin{bmatrix}0\\1\end{bmatrix}$$

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3. **(AA6)** Find the particular solution to the initial value problem:

$$\mathbf{x}'(t) = \begin{bmatrix} 2 & -1 \\ 3 & -2 \end{bmatrix} \mathbf{x}$$

and $\mathbf{x}(0) = [1, 2]^T$.