Problem 1 (10pts)

Consider the following system

\[ \vec{x}'(t) = \begin{bmatrix} 1 & 5 \\ -2 & -1 \end{bmatrix} \vec{x}(t). \] (1)

Find a fundamental matrix solution, \( X(t) \), for the system and write it in the box below.

\[
X(t) = 
\]
Problem 2 (15 pts)

A fundamental matrix solution to the homogeneous system \( \vec{x}' = A\vec{x} \), where \( A = \begin{bmatrix} 2 & 3 \\ -1 & -2 \end{bmatrix} \), is \( X(t) = \begin{bmatrix} -e^{-t} & 3e^t \\ e^{-t} & -e^t \end{bmatrix} \).

1. (2 pts) What is the classification of the origin for this system? Write your answer in the box below.

2. (13 pts) Use the given fundamental matrix to find the general solution to the forced system

\[
\vec{x}' = \begin{bmatrix} 2 & 3 \\ -1 & -2 \end{bmatrix} \vec{x} + \begin{bmatrix} 0 \\ e^t \end{bmatrix}.
\]  

Write your answer in the box below. (Hint: \( \vec{x}_p = X \int X^{-1} \vec{r} dt \))

\[
\vec{x}_g =
\]