

1. (6 points) Solve  $\frac{d\vec{u}}{dt} = A\vec{u}$  if  $A = \begin{bmatrix} 3 & 1 \\ -1 & 5 \end{bmatrix}$ .

2. (6 points) Compute  $e^{At}$  if  $A = \begin{bmatrix} 0 & 0 & 0 \\ -1 & 0 & 0 \\ 1 & 2 & 0 \end{bmatrix}$ , and then find a basis for the solution set for  $\frac{d\vec{u}}{dt} = A\vec{u}$ .

3. (8 points) Find the general solution for  $\begin{cases} x' = 3x - 4y + t \\ y' = 2x - 3y + 1 \end{cases}$ . Show work. If you use a method different from those proved in lecture, then you must prove it works.