Some Additional Theory in Differential Equations

Now we need some results from the theory of linear differential equations.

Fact 1: EVERY solution of $du/dt = Au$ has the form $u = c_1 u_1 + c_2 u_2$ provided u_1 and u_2 are linearly independent solutions (assuming A is 2×2 and u is in $\mathbb{R}^2$).

Fact 2: The c_i are determined by specifying an "initial condition" for u (i.e, for v and w):

$$u(0) = \left[\begin{array}{c} v(0) \\ w(0) \end{array} \right] = \left[\begin{array}{c} 8 \\ 5 \end{array} \right] \quad \text{(say)}$$

For example:

$$\left[\begin{array}{c} 8 \\ 5 \end{array} \right] = c_1 u_1(0) + c_2 u_2(0) = c_1 \left[\begin{array}{c} 1 \\ 1 \end{array} \right] + c_2 \left[\begin{array}{c} 5 \\ 2 \end{array} \right] = \left[\begin{array}{cc} 1 & 5 \\ 1 & 2 \end{array} \right] \left[\begin{array}{c} c_1 \\ c_2 \end{array} \right]$$