$$\underline{\underline{y'' + 3y' = 0}} \implies y = c_1 + c_2 e^{-3t}$$

Series solution: $e^x = (1 + x + \frac{1}{2!}x^2 + \frac{1}{3!}x^3 + \cdots)$

$$e^{-3t} = 1 - 3t + \frac{1}{2!}(-3t)^2 + \frac{1}{3!}(-3t)^3 + \cdots$$

$$y = a_0 + a_1\left(x - \frac{3}{2}x^2 + \frac{3}{2}x^3 - \frac{9}{8}x^4 + \cdots\right)$$

$$y = a_0 + 3a_1\left(\frac{1}{3}x - \frac{1}{2}x^2 + \frac{3}{3!}x^3 - \frac{9}{4!}x^4 \cdots\right)$$

$$= a_0 - \frac{a_1}{3}\left((-3x) + \frac{9}{2}x^2 - \frac{27}{3!}x^3 + \frac{81}{4!}x^4 + \cdots\right)$$

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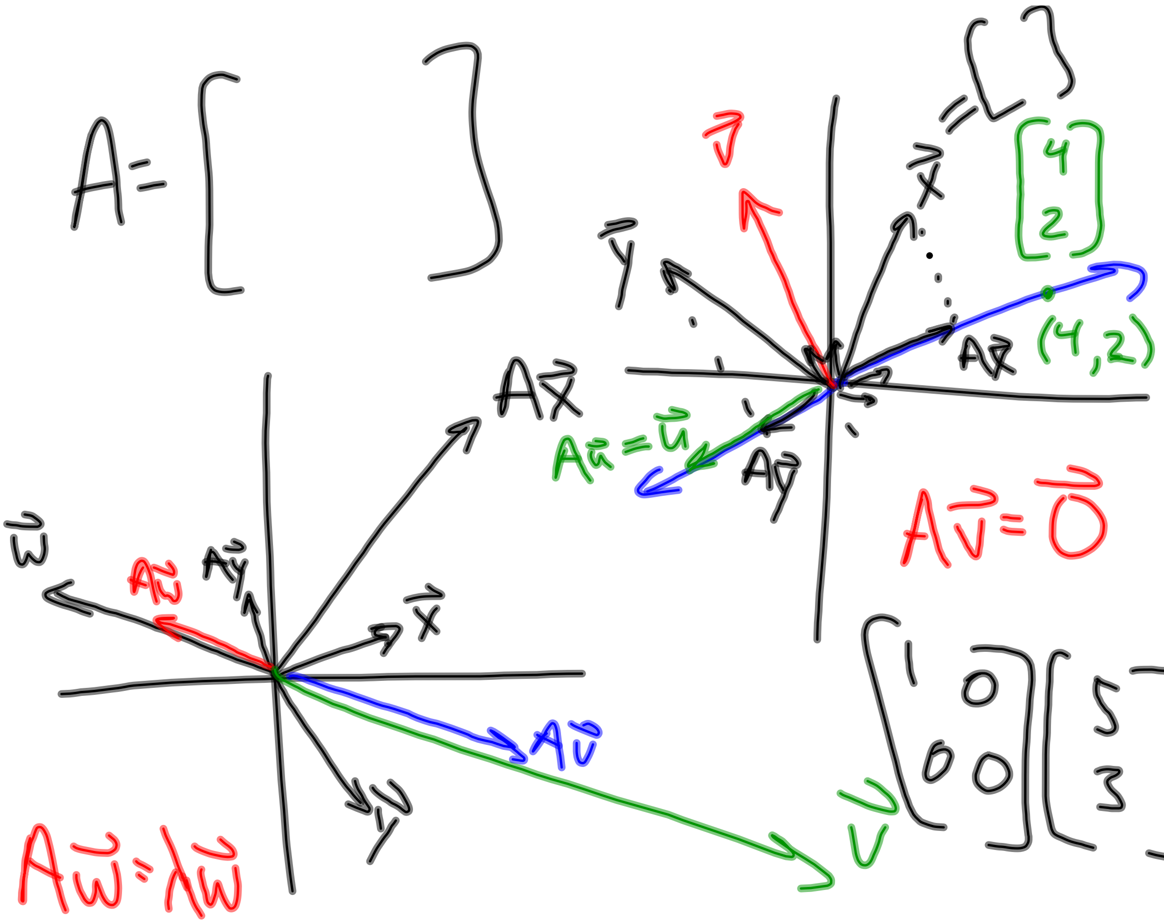
$A = \begin{bmatrix} \; & \; \end{bmatrix}$



$A\vec{v} = \vec{0}$

$\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} 5 \\ 3 \end{bmatrix}$

$A\vec{w} = \lambda \vec{w}$

$$\begin{bmatrix}1 & 2\\ 3 & 2\end{bmatrix} \qquad \lambda = 4, -1$$

$$A\vec{x} = \lambda\vec{x} \qquad xy = 5$$

$$A\vec{x} - \lambda\vec{x} = \vec{0} \qquad 5\begin{bmatrix}3\\2\end{bmatrix} = \begin{bmatrix}5 & 0\\ 0 & 5\end{bmatrix}\begin{bmatrix}3\\2\end{bmatrix} = \begin{bmatrix}15\\10\end{bmatrix}$$

$$A\vec{x} - \lambda I\vec{x} = \vec{0}$$

$$\underbrace{(A - \lambda I)}_{\det(A-\lambda I)=0}\vec{x} = \vec{0} \Longrightarrow \begin{bmatrix}-3 & 2\\ 3 & -2\end{bmatrix}\begin{bmatrix}c_1\\c_2\end{bmatrix} = \begin{bmatrix}0\\0\end{bmatrix}$$

$$\begin{bmatrix}-3c_1+2c_2\\ 3c_1-2c_2\end{bmatrix} = \begin{bmatrix}0\\0\end{bmatrix}$$

$$3c_1 - 2c_2 = 0$$

$$3c_1 = 2c_2$$

$$c_1 = \frac{2}{3}c_2 \quad \vec{c} = \begin{bmatrix}\frac{2}{3}c_2\\ c_2\end{bmatrix} = c_2\begin{bmatrix}\frac{2}{3}\\ 1\end{bmatrix} = \tilde{c}_2\begin{bmatrix}2\\3\end{bmatrix}$$

$$\begin{bmatrix}2\\3\end{bmatrix}, \begin{bmatrix}8\\12\end{bmatrix}, \begin{bmatrix}1\\ \frac{3}{2}\end{bmatrix}$$

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$$y'' + by' + cy = f(t)$$

$$Y(s) = \frac{\quad}{(\quad)} + \frac{\quad}{(\quad)(\quad)}$$

$$\vec{x} = A\vec{x}, \quad \vec{x}(0) = \begin{bmatrix} \\ \\ \end{bmatrix}$$

$x_1(0) = \#$

$x_2(0) = \#$

$$\vec{x} = d_1 \begin{bmatrix} \\ \\ \end{bmatrix} e^{\square} + d_2 \begin{bmatrix} \\ \\ \end{bmatrix} e^{\square}$$

$x + 2y = 5$

$2x + 7y = 3$