So: $\lambda_1 = 2, \quad v_1 = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$

$\lambda_2 = -1, \quad v_2 = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$

(5) $\frac{d}{dt}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 & -1 \\ 3 & -2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix}$

$A = \begin{pmatrix} 2 & -1 \\ 3 & -2 \end{pmatrix} \quad ; \quad A - \lambda I = \begin{pmatrix} 2-\lambda & -1 \\ 3 & -2-\lambda \end{pmatrix}$

$\Rightarrow (2-\lambda)(-2-\lambda) + 3 = 0$

$\Rightarrow \lambda^2 - 4 + 3 = 0$

$\boxed{\lambda = \pm 1}$

$\boxed{\lambda = 1}$ $\begin{pmatrix} 2 & -1 \\ 3 & -2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x \\ y \end{pmatrix} \Rightarrow 2x - y = x \Rightarrow x = y$

$v_1 = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$

$\boxed{\lambda = -1}$ $\begin{pmatrix} 2 & -1 \\ 3 & -2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = -\begin{pmatrix} x \\ y \end{pmatrix} \Rightarrow 2x - y = -x \Rightarrow y = 3x$

$v_2 = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$

$\Rightarrow$ general solution is

$$\begin{pmatrix} x(t) \\ y(t) \end{pmatrix} = c_1 e^{t}\begin{pmatrix} 1 \\ 1 \end{pmatrix} + c_2 e^{-t}\begin{pmatrix} 1 \\ 3 \end{pmatrix}.$$