

1. (1)

$$AB = \begin{pmatrix} 0 & -2 & -1 \\ 2 & 3 & 3 \\ -1 & 9 & 2 \end{pmatrix}$$

(2)

$$B^{-1} = \begin{pmatrix} 7 & 3 & -1 \\ 2 & 1 & 0 \\ -6 & -3 & 1 \end{pmatrix}$$

$$(3) \det A = -7, \quad \det(A^{-1}) = -1/7$$

2. Basis : $\{(-1 \ 3 \ 1)^T, (2 \ -1 \ 3)^T\}$
rank $A = 2$

3. Yes

$$4. y(t) = 2e^{-t} + 3te^{-t}$$

$$5. y(t) = c_1e^{-t} + c_2e^{5t} + \left(-\frac{3}{8}t + \frac{3}{32}\right)e^t$$