

Singular Value Decomposition

1. Find the full and reduced singular value decomposition of the following matrix.

$$A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}$$

Hint: It's easier to first find the SVD of A^T .

2. Find three different 2×5 matrices whose nonzero singular values are 2 and 3. It's okay to express these matrices as products of other matrices.

Linear Ordinary Differential Equations

1. Which of the following functions are solutions to the differential equation $y'' - y = 2 - t^2$?

(a) $f(t) = t^2$

(c) $h(t) = \sin(t) + t^2$

(b) $g(t) = e^t$

(d) $k(t) = 2e^t + t^2$

2. Which of the functions in the previous problem are solutions to the initial value problem $y'' - y = 2 - t^2$, $y(0) = 1$, $y'(0) = 1$?
3. Show that if f and g are both solutions to the differential equation $y''' - 5y'' + 17y' - 3y = 0$ then so is $5f + 3g$.