Linear differential equations

1. Introduction & overview

Example 1: $y'' - 2y' + y = 0$

- linear, second order, homogeneous, with constant coefficients

- Are $y_1(x) = e^x$ and $y_2(x) = x e^x$ solutions?

$y_1' = e^x$ $\quad$ $y_2' = x e^x + e^x$

$y_1'' = e^x$ $\quad$ $y_2'' = x e^x + 2e^x$

$$y_1'' - 2y_1' + y_1 = e^x - 2e^x + e^x = 0 \quad \checkmark$$

$$y_2'' - 2y_2' + y_2 = x e^x + 2e^x - 2(x e^x + e^x) + x e^x$$
$$= 0 \quad \checkmark$$

- Are y_1 & y_2 linearly independent?
They are because they are not proportional to one other.