Section 4.3

Math 252: Graphs of Solutions to 2nd Order Linear DEs

Homogeneous Case

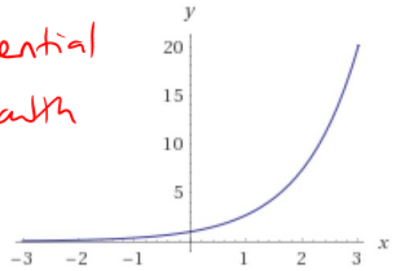
$ay'' + by' + cy = 0$

Solutions of the form $y = C_1 e^{m_1 x} + C_2 e^{m_2 x}$

two distinct roots

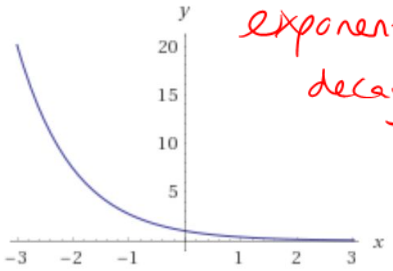
$y = e^x$

exponential growth

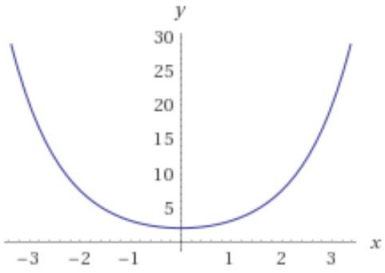


$y = e^{-x}$

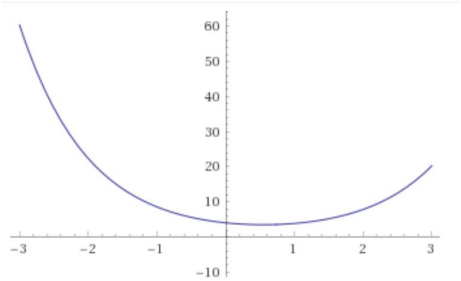
exponential decay



$y = e^x + e^{-x}$

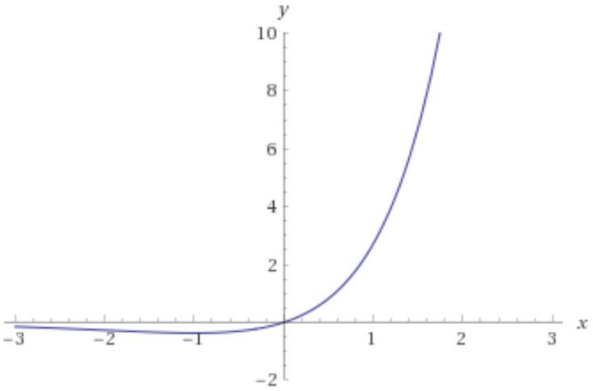


$y = 2e^x + 3e^{-x}$

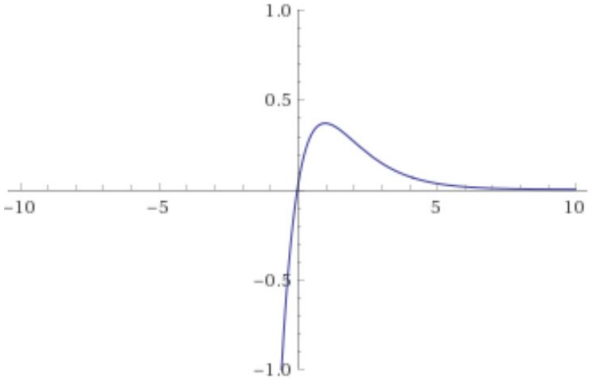


Solutions of the form $y = (C_1 + C_2 x)e^{mx}$ one repeated root

$y = xe^x$

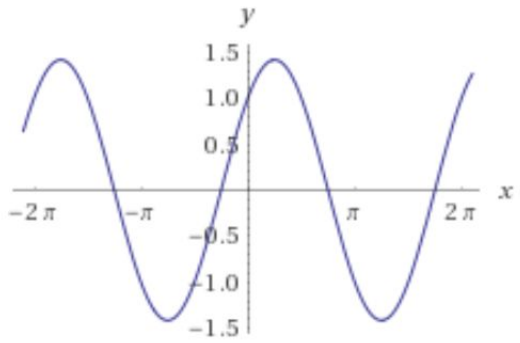


$y = xe^{-x}$



Solutions of the form $y = C_1 \cos \beta x + C_2 \sin \beta x$ $m = \pm \beta i$ $(\alpha = 0)$

$y = \cos x + \sin x$

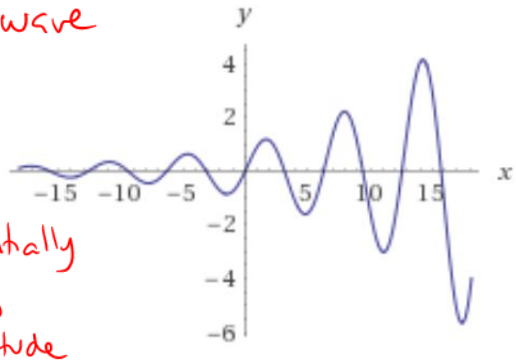


Sine wave with a phase shift

Solutions of the form $y = e^{\alpha x}(C_1 \cos \beta x + C_2 \sin \beta x)$ $m = \alpha \pm \beta i$

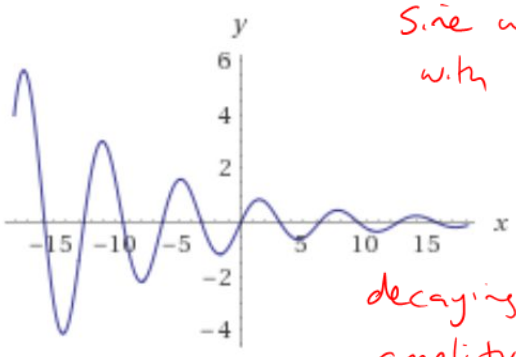
$y = e^{x/10} \sin x$

Sine wave with exponentially growing amplitude



$y = e^{-x/10} \sin x$

Sine wave with decaying amplitude



All graphs generated by:

Wolfram Alpha LLC. 2020. Wolfram|Alpha. `http://www.wolframalpha.com/` (accessed February 4, 2020).