$x = c_1 e^{-4t} + c_2 e^{4t}$

$x' = -4c_1 e^{-4t} + 4c_2 e^{4t}$

$x'' = 16c_1 e^{-4t} + 16c_2 e^{4t}$

$\frac{d^2x}{dt^2} + 16x = 0$

$LHS = x'' + 16x = 16c_1 e^{-4t} + 16c_2 e^{4t} + 16(c_1 e^{-4t} + c_2 e^{4t})$

$= 32c_1 e^{-4t} + 32c_2 e^{4t}$

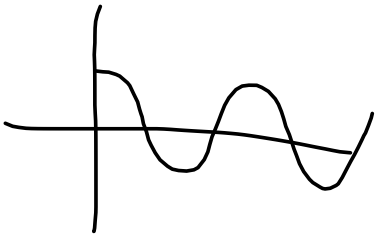
$\neq 0$

$x = c_1 e^{-4t} + c_2 e^{4t}$ is not a sol to $x'' + 16x = 0$

$$\frac{d^2x}{dt^2} + 16x = 0$$

$$\frac{d^2x}{dt^2} = -16x$$

$$x = \sin 4t, \cos 4t$$



$x = \frac{1}{4}e^{-4t}$ satisfies $x(0) = \frac{1}{4}, x'(0) = 0$

$x(0) = \frac{1}{4}e^{0} = \frac{1}{4}$

$x' = -e^{-4t}$

$x'(0) = -1 \neq 0$ so x does not satisfy $x'(0) = 0$

$5x^4 - 7x^3 + \cdots + 2 =$

Not linear

$\frac{dy}{dx} - \frac{x}{y} = 0$ $\frac{dy}{dx} + \{\}y = 0$

$\frac{dy}{dx} - \frac{y}{x} = 0$

$\frac{dy}{dx} + \left(-\frac{1}{x}\right)y = 0$

$$\frac{dy}{dx} = \frac{x}{y}$$

$$y\frac{dy}{dx} = x$$

$$\frac{d^4y}{dx^4} = 0.092$$

$$\frac{d^3y}{dx^3} = 0.092x + C_1$$

$$\frac{d^2y}{dx^2} = \frac{0.092}{2}x^2 + C_1x + C_2$$

C. $y' + 2y = y^2$

$y' = y^2 - 2y$

$F(x,y) = F(y)$

Autonomous

A. $\frac{dy}{dx} - \frac{x}{y} = 0$

$\frac{dy}{dx} = \frac{x}{y}$

$F(x,y) = \frac{x}{y}$

B. $y' - 2xy = x$

$y' = 2xy + x$

$= x(2y+1)$

$= g(x)h(y)$

Separable

$y' + 2xy = x^2$

$y' = 2xy + x^2$

$= x(2y+x)$

Not separable