

Problem Definition

Problem 35. Determine whether the function

$$y = \frac{4}{x}$$

is a solution for the following differential equation

$$y^{(4)} - 16y = 0$$

Solution Step 1:

The idea is to substitute the given function $y(t)$ and the fourth derivative of $y(t)$ into the equation to see if the equation is true for this choice. So, for

$$y = \frac{4}{x} = 4x^{-1}$$

we compute the derivative with respect to t . This is

$$\begin{aligned}y' &= -4x^{-2} \\y'' &= 8x^{-3} \\y''' &= -24x^{-4} \\y^{(4)} &= -96x^{-5}\end{aligned}$$

Solution Step 2:

Now we try out the function and fourth derivative. For the ode

$$y^{(4)} - 16y = 0$$

Substituting the function and the fourth derivative into the left hand side we obtain

$$y^{(4)} - 16y = -96x^{-5} - 16(4x^{-1}) = -96x^{-5} - 64x^{-1} \neq 0$$

Since the left hand side cannot be zero for this function, the given function cannot be a solution of the ordinary differential equation.