Math Diversion Problem 862

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CONCERNING HORSES

> You cannot train a horse with shouts and
> expect it to obey a whisper.
> — Dagobert D. Runes

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Source: https://www.youtube.com/watch?v=nLaIpO8YnpE
Title: The Weirdest Equation Yet
  Presenter:  SyberMath
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1 Problem

Given the relation

$$y + \ln y = x + e^x \,, \tag{1}$$

find a simpler relation between x and $y > 0$ over the reals.

2 Solution

Let's begin by transforming the RHS of (1) by the change of variables;

$$x = \ln z \,. \tag{2}$$

Then (1) becomes

$$y + \ln y = \ln z + z \,. \tag{3}$$

By the way, this specific transformation is a standard trick one learns by working with a lot of problems that involve both logarithms and exponentials.

So, the obvious solution to (3) is

$$y = z \,. \tag{4}$$

But this means that

$$y = e^x \,. \tag{5}$$