Math Diversion 1054

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> The first thing you notice about Cedric Villani
> is that he is wearing the wrong century.
> — Turing, "Cedric Villani, The Most
> Charismatic Man in Mathematics"

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Source:  https://www.youtube.com/watch?v=xE1cDs85EcA
Title: 99% of Students Can't Solve This
 Presenter: MindYourDecisions
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1 Problem

Given the relation

$$x^{x^3} = 3\,, \tag{1}$$

find the real values of x.

2 Solution

Let's try to solve this with an α transformation. So, let

$$x = 3^{\alpha}\,. \tag{2}$$

Then (1) becomes

$$(3^{\alpha})^{3^{3\alpha}} = 3\,, \tag{3}$$

which simplifies down to

$$3^{\alpha 3^{3\alpha}} = 3^1\,. \tag{4}$$

On equating exponents, we get

$$\alpha 3^{3\alpha} = 1\,. \tag{5}$$

By inspection, we see that $\alpha = 1/3$ is the solution, implying that

$$x = 3^{1/3}\,. \tag{6}$$