Math Diversion 979

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December 21, 2025

> You have to know what to look for, so you can spot it.
> — Papago Native American
> drug-enforcement border scout

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Source: https://www.youtube.com/watch?v=8FmRRCuOqyo
Title: A Challenging Exponential Problem
 Presenter: Click Academics
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1 Problem

Given the relation

$$x^x = 2^{x+4}\,, \tag{1}$$

solve for real values of x.

2 Solution

Let

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

then (1) becomes

$$2^{\alpha 2^\alpha} = 2^{2^\alpha+4}\,. \tag{3}$$

On setting the exponents equal, we have that

$$\alpha 2^\alpha = 2^\alpha + 4\,, \tag{4}$$

which simplifies to

$$(\alpha - 1)2^\alpha = 2^2\,. \tag{5}$$

By inspection, we can see that

$$\alpha = 2\,. \tag{6}$$

Thus, by (2),

$$x = 4\,. \tag{7}$$