Math Diversion Problem 107

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January 24, 2025

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

The YouTube video is found at:

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Source: https://www.youtube.com/watch?v=bcG73tJvGz4
Title: Advance Algebra | Olympiad Mathematics
 Presenter: Master T Maths Classes
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1 The Problem

Given the relation

$$4^{x+1} - 4^{x-1} = 25\,, \tag{1}$$

find the values of x.

2 The Solution

My plan is to use a logarithmic substitution:

$$x \equiv \log_4 \beta\,. \tag{2}$$

Then (1) becomes

$$4^{\log_4 \beta + 1} - 4^{\log_4 \beta - 1} = 25\,. \tag{3}$$

From this, we get

$$4\beta - 4^{-1}\beta = 25\,. \tag{4}$$

On solving for β, we get

$$\beta = \frac{20}{3}\,. \tag{5}$$

So, for x, we get

$$x = \log_4 \frac{20}{3} = \frac{\log \frac{20}{3}}{\log 4}\,. \tag{6}$$