# Math Diversion 1012

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January 15, 2026

A monolithic AGI is a black box with a god complex.
A pipeline AGI is infrastructure.
History favors infrastructure.
— Copilot commenting
on successful AGI

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Source: https://www.youtube.com/watch?v=VTxiSSLz7M4
Title: We Solved Using A Perfect Square Trinomial!
 Presenter: Andy Math
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## 1 Problem

Given the relations

$$\frac{x^2}{y^2} + \frac{y^2}{x^2} = 3z + 2\,, \tag{1a}$$

$$\frac{x}{y} + \frac{y}{x} = z\,, \tag{1b}$$

solve for $z$, where $x, y, z$ are real numbers.

## 2 Solution

Let $\eta \equiv x/y$, then the given equations become

$$\eta^2 + \eta^{-2} = 3z + 2\,, \tag{2a}$$

$$\eta + \eta^{-1} = z\,. \tag{2b}$$

On squaring (2b), we get

$$\eta^2 + \eta^{-2} + 2 = z^2\,, \tag{3}$$

Combing (4) with (2a), we have that

$$z^2 - 3z - 4 = 0\,, \tag{4}$$

which has solutions

$$z = -1, 4\,. \tag{5}$$

So, we're not quite finished. We have yet to do a consistency check with the givens that $x, y$ are real numbers. I'm going to let WolframAlpha help me with this, by, one at a time, using these $z$ solutions in (1a) and (1b):

For $z = -1$:

$$\frac{x^2}{y^2} + \frac{y^2}{x^2} = -1\,, \tag{6a}$$

$$\frac{x}{y} + \frac{y}{x} = -1\,, \tag{6b}$$

and this combination fails.

For $z = 4$:

$$\frac{x^2}{y^2} + \frac{y^2}{x^2} = 14\,, \tag{7a}$$

$$\frac{x}{y} + \frac{y}{x} = 4\,, \tag{7b}$$

and this combination succeeds.