

# Math Diversion Problem 59

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In mathematics, you don't understand things.

You just get used to them.

— John von Neumann

The YouTube video is found at:

Source: <https://www.youtube.com/watch?v=Q6vFA8FqKzA>

Title: Indian 1 Olympiad Math Algebraic Exponential

| Find  $x$ ?

Presenter: Math Master TV

## 1 The Problem

Given the relation

$$6^x + 9^x = 2^{2x+1}, \quad (1)$$

find the integer values of  $x$ .

## 2 The Solution

First, let's rearrange (1) to get

$$9^x = 2^{2x+1} - 6^x, \quad (2)$$

which can be rewritten as

$$9^x = 2^{2x+1} - 2^x 3^x = 2^x (2^{x+1} - 3^x). \quad (3)$$

Now, for all non-negative integers, the LHS will be odd. But for all positive integers, the RHS will be even. Thus, we have only one choice for  $x$ :

$$x = 0. \quad (4)$$