

Math Diversion Problem 774

P. Reany

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It's not that I'm so smart; it's just that
I stay with problems longer.
— Albert Einstein

Source: <https://www.youtube.com/watch?v=4SdooW2yldo>
Title: A Harvard University interview math tricks
Presenter: Maths Explorer

1 Problem

Given the relation

$$a! = a^3 - a, \tag{1}$$

find the integer solutions of a .

2 Solution

Let's not forget the trivial solution $a = 0$ then it's on to the fun stuff.

For $a \neq 0$, (1) becomes

$$(a - 1)! = a^2 - 1. \tag{2}$$

Let's solve this by use of a table, if we can.

a	$(a - 1)!$	$a^2 - 1$
2	1!	4 - 1
3	2!	9 - 1
4	3!	16 - 1
5	4! = 24	25 - 1 = 24

Table 1: Thus we found the answer $a = 5$.