

## Addition Done Right Trick

### What the audience sees.

Two volunteers from the audience come up to the board and write two numbers. They are then asked to write a sequence of eight more numbers where each of the next numbers in the sequence is the sum of the previous two numbers and then add up all ten numbers. Before all the ten numbers in the sequence have been computed, you start working on the same task in your head and find the sum much quicker than the volunteers.

### How you do it.

You ask two volunteers from the audience to come up to the board and write any two numbers from 1 to 10 (if you are good at multiplying by 11 then larger numbers can also be chosen). Then you ask them to construct a Fibonacci-like sequence where the next term in the sequence is the sum of the previous two numbers. You ask them to write ten terms in this sequence including the first two numbers that they randomly wrote on the board. You also tell them that their task is to find the sum of these ten numbers once they are done computing the terms. Meanwhile, you observe the volunteers writing down the terms of the sequence. When they have written out seven terms, you turn away and exclaim that you will now compute the rest of the terms and also the sum of these terms in your head. While the volunteers are writing the ten terms you multiply the seventh term that you just saw by 11 and say that as the answer for the sum of the ten terms. Indeed, you are right!

### Why it works.

Suppose the two random numbers that the volunteers wrote down on the board are  $a$  and  $b$  respectively. Since every term from here on is constructed in a Fibonacci-like manner, where it is the sum of the previous two terms, we have the following list of the first ten terms:

1.  $a$
2.  $b$
3.  $a + b$
4.  $a + 2b$
5.  $2a + 3b$
6.  $3a + 5b$
7.  $5a + 8b$
8.  $8a + 13b$
9.  $13a + 21b$
10.  $21a + 34b$

The sum of these ten terms is  $55a + 88b = 11(5a + 8b)$ . Note that this is 11 times the 7<sup>th</sup> term in this list. So, once the volunteers have computed the seventh term in the sequence, you quickly multiply this term by 11 to get the sum of all the ten terms.