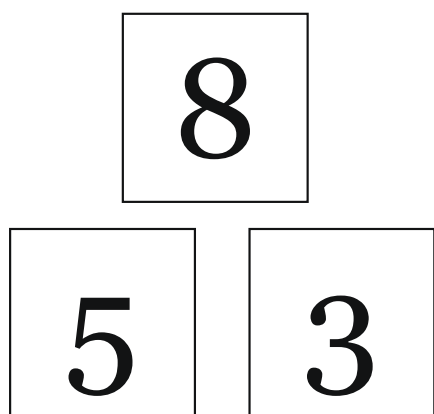


A MATHEMATICIAN AT PLAY

Stacking numbers to make pyramids

You might have encountered triangles that connect three numbers based on their sum and differences. What if we decide to play with them, extending them to three, four and five layers? **Daniel Finkel** introduces you to these number pyramids and then poses puzzles with three, four and even five layers!

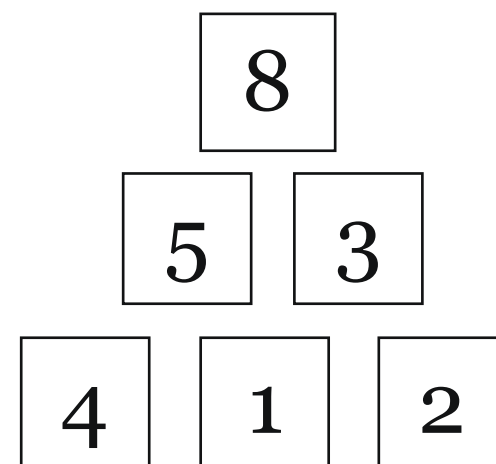
Schools sometimes teach “fact families:” triangles that connect three numbers based on their sum and differences. For example, the triangle below expresses the series of relationships: $5 + 3 = 8$, $8 - 5 = 3$, and $8 - 3 = 5$.



Nothing too mysterious is happening yet, but the triangle shape calls out to be extended. So let's extend it! I call these shapes “pyramids,” and I like them best if I can fill them with positive whole numbers, without repeating any number, so that every number is the sum of the two directly below it. Following mathematicians' penchants for making up words when we need them, I'll call pyramids that satisfy all these conditions **nice**.

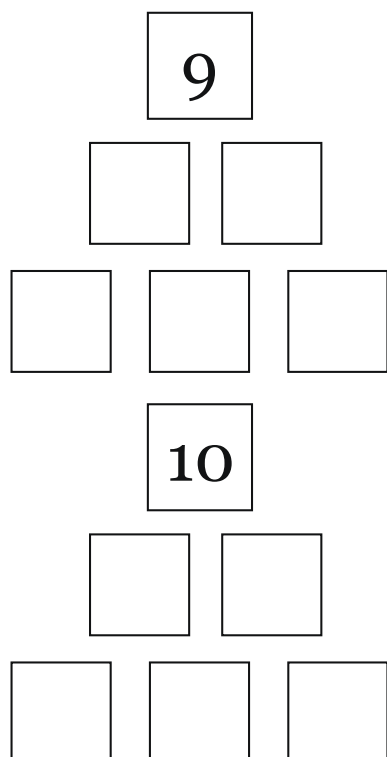
For example, here's a nice pyramid with an 8 at its top. It is nice because:

- * It is filled with positive whole numbers
- * No number occurs more than once in the pyramid
- * Every number is the sum of the two below it.

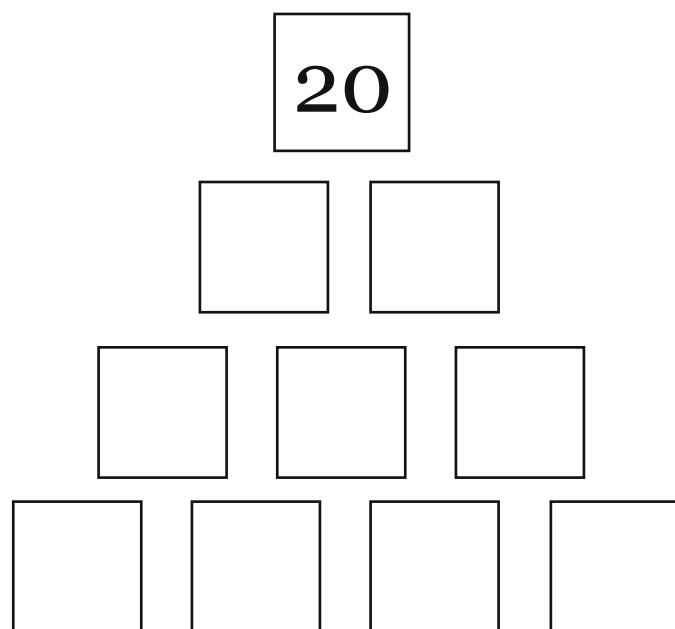


I claim that 8 is the smallest number that can be in a nice pyramid with three layers. (Do you believe me?)

PUZZLE 1 Fill in these pyramids so that they are nice. In other words, fill in the pyramids so every number is the sum of the two positive whole numbers below it, and no number occurs more than once.

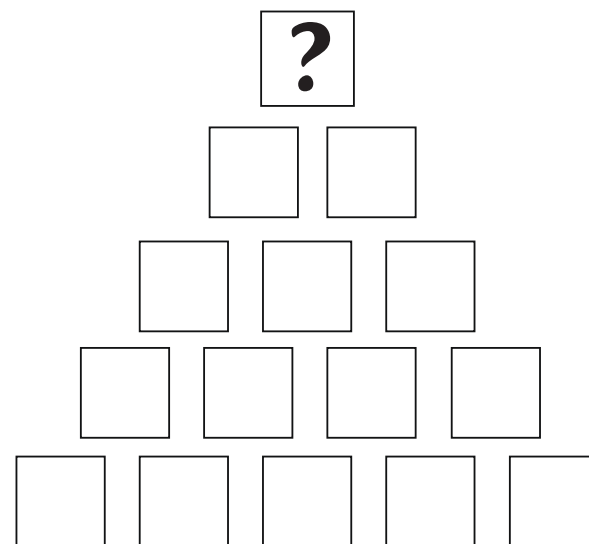


PUZZLE 2 Fill in the blank squares to make a nice pyramid below.



Dan Finkel is the founder of Math for Love, an organisation devoted to transforming how math is taught and learned. He is the creator of mathematical puzzles, curriculum, and games, including the best-selling *Prime Climb* and *Tiny Polka Dot*.

PUZZLE 3 What is the smallest number that can be at the top of a nice pyramid with 5 layers?



(Hint: try solving this for pyramids with 3 or 4 layers first)