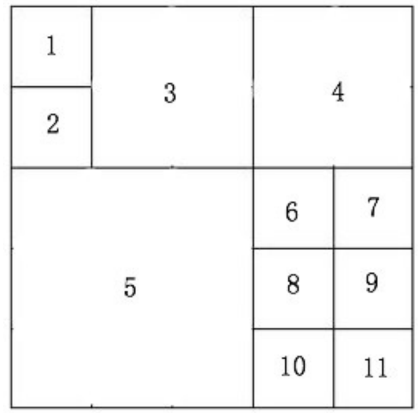
Squareable Numbers

Here is one way to build a square from 11 smaller squares. We call the number 11 “squareable.” In general, the number *n* is “squareable” if we can build a square out of precisely *n* smaller squares with no leftover space.



Big Question: Which numbers are squareable?

1. To get you started, here are the numbers from 1 to 25. Play around with building squareable numbers. Circle which numbers are squareable as you go.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

1. Are there any patterns or strategies that help you determine whether a number is squareable or not?

2. Is 26 squareable? 31? 99? 1000? How can you check if a number is squareable?

3. Provide a complete description of squareable numbers.

4. Are any numbers not squareable? If so, prove it.

5. Generalize! Define “triangulable” numbers or “pentagonalizable” or “cube-able” numbers, and explore what numbers are of each type.

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<u>Teachers Notes and Selected Answers</u>

This is a great problem, and kids can get working on it right away. Help them by giving them graph paper, and by getting them to circle the squareable numbers as they build diagrams on their paper--this is give them some momentum right away.

I'm inclined not to solve this problem for you—it's that good. But I can give you a hint: think about "moves" that affect the number of squares in a regular way. You can do this either by dividing a square into pieces, say, cutting a square into quarters. If you know a certain number N is squareable, what other number do you know for sure must be squareable?

See http://wordplay.blogs.nytimes.com/2013/04/08/squareable/ for more on this problem, including a solution.