the nmf weekly

Ask your math friend, James

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SQUARES: Solutions

puzzle #1

In a five-by-five grid ...

There are 25 one-by-one squares.

Show that there 16 two-by-two squares, 9 three-by-three squares, and 4 four-by-four squares.

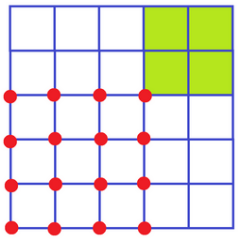
There is 1 big five-by-five square.

What do you notice about the numbers 25, 16, 9, 4, and 1? Can you explain why what you are noticing must be true?

ANSWER TO PUZZLE 1:

To count the two-by-two squares, for example, ask: Where could the bottom left corner of a two-by-two square be? We see that we get a four-times-four array of possible bottom left corners. The count of two-by-two squares is thus the square number 16.

In this way we see that the count of squares of any particular size must be a square number!



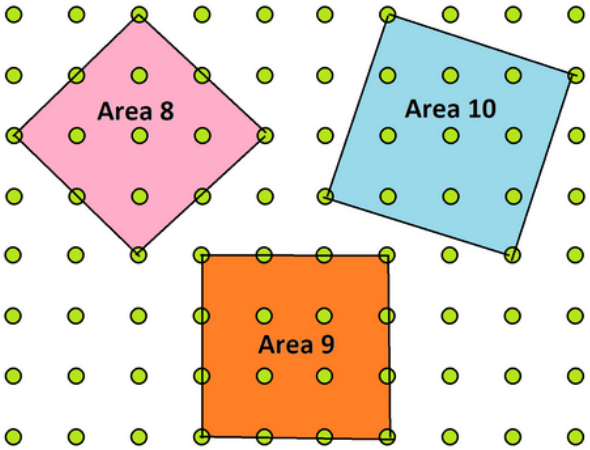
puzzle #2

Draw a tilted square of area 8.
Draw a non-tilted square of area 9.
Draw a titled square of area 10.

For which of the numbers 1 through 20 is it possible to draw a square of that area?

ANSWER TO PUZZLE 2:

It is possible to draw squares of areas 1, 2, 4, 5, 8, 9, 10, 13, 16, 17, 18, and 20. (Hard question: Why are the other areas impossible to produce?)



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The NMF Weekly is written by mathematician Dr. James Tanton as a resource for friends and fans of the 2021 National Math Festival.

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