A MATHEMATICIAN AT PLAY

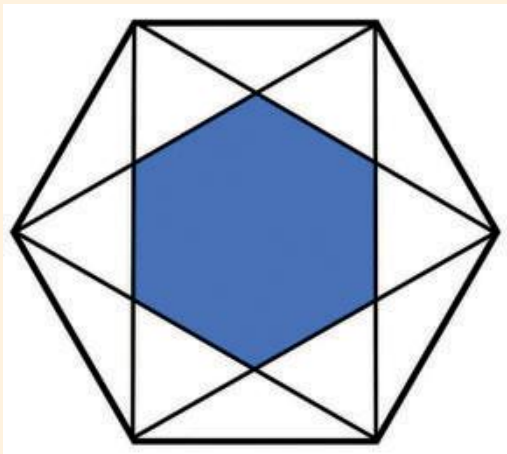
Connecting the dots to create an area...

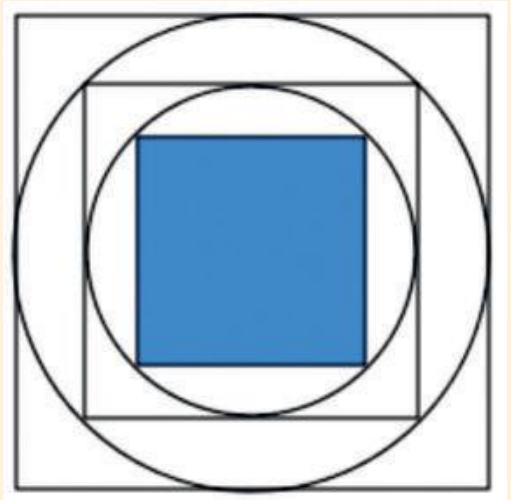
Do you start rummaging your brain every time a problem is posed to determine the area of a shape? And do you often give up when you fail to recollect that specific formula? If you answered yes to either of these, it's time to change that now. For ***Daniel Finkel*** *suggests that it is more important to remember how we got there, than getting there directly every time.*

A professor of mine once said, "**Don't memorise formulas, memorise arguments.**" An argument in math is like a story: it takes us from an unsuspecting beginning into a journey of challenge, surprise, and insight. What we take home at the end is, perhaps, a formula. The meaning of the formula is that it reminds us of the argument, and allows us to take what we learned from the journey and apply it to new situations.

Why should we memorise formulas for the areas of rectangles, triangles, trapezoids, and parallelograms when the same fundamental argument is behind them all? **Instead of memorising, take the journey.** This week's puzzles are all about area, but from an angle you may not have seen before. Formulas will get you only so far. You'll need arguments.

1 In each of these figures, I have created a shape by starting out with a shape and then joining points within them in a certain way. The dots are joined in such a way so as to form a hexagon within a hexagon in the first image, and a square within a square in the second.





THE PUZZLE

What area of each of the shapes below is shaded?

2 Let's say the red square (Figure 1) has an area 1. In other words, we'll use the red square as kind of ruler and measure the other squares against it.

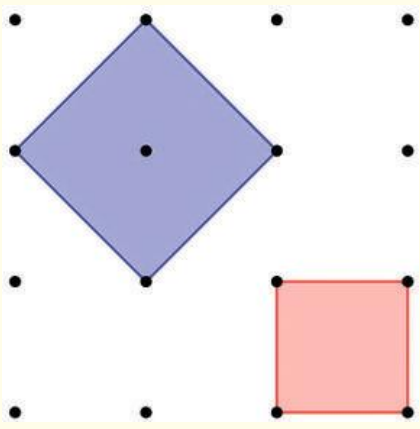


Figure 1

THE PUZZLES

Part 1 Show that the small blue square (in Figure 1) has area 2.
Part 2 Find the area of the purple square (Figure 2).
Part 3 Of the following numbers, one of them cannot be the area of a square with all its corners on a grid, no matter how large the grid is. Which one is it?
17, 18, 19, 20

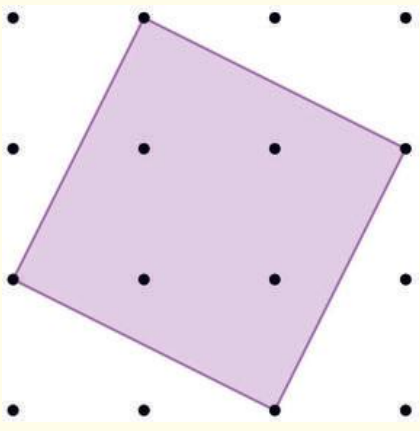
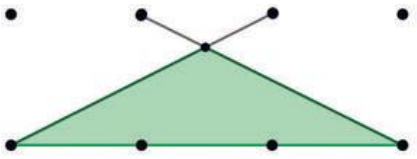


Figure 2

RESEARCH QUESTION

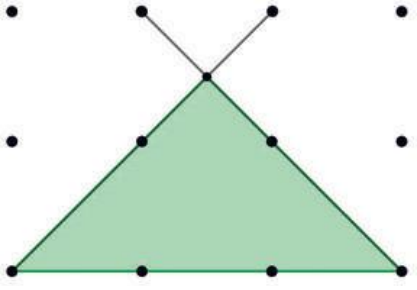
Is there any kind of pattern in the possible areas a grid square can have?

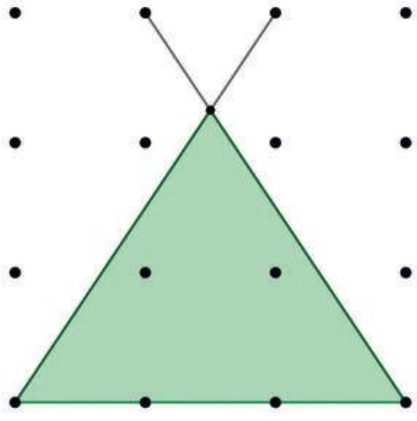
3 In each of the following triangles, the base is the same, but the height varies.



THE PUZZLES

What are the areas of the three triangles shown?





You can write to Dan Finkel (dan@mathforlove.com) with your responses to the **Research Question** [subject: 2Play].
Turn to the next page for answers to the three puzzles.

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 bestselling Prime Climb and Tiny Polka Dot.