Lattice Polygons, Part 2

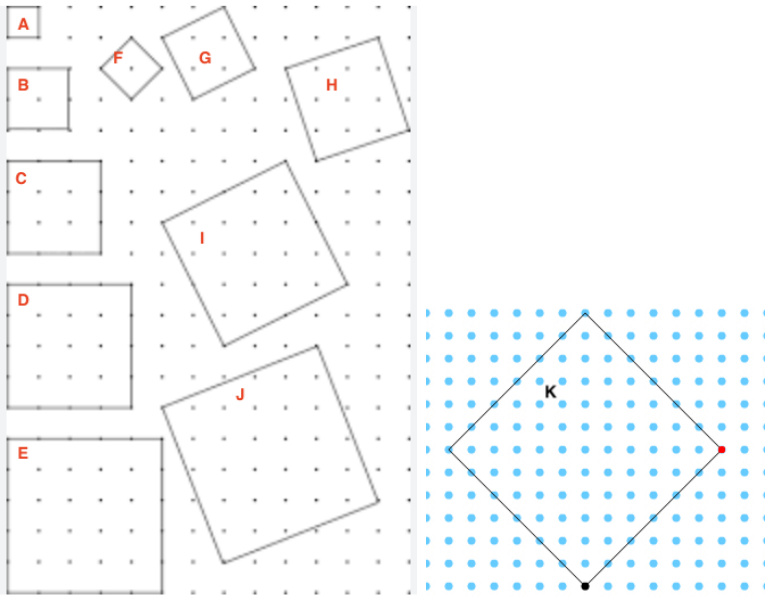
A lattice point is a point where there is a peg on the geoboard, or a point where grid lines cross on graph paper, or a point marked with a dot on lattice paper.
A lattice square is a square with all vertices at lattice points.

1. Assume each square of the graph paper has area 1. Draw a lattice square with
   (a) area 1
   (b) area 4
   (c) area 36
2. Is it possible to draw a lattice square with
   (a) area 2?
   (b) area 3?
   (c) area 5?
3. What numbers are possible for the areas of lattice squares?

Area	Possible?	Area	Possible?	Area	Possible?
1		11		21	
2		12		22	
3		13		23	
4		14		24	
5		15		25	
6		16		26	
7		17		27	
8		18		28	
9		19		29	
10		20		30	

Lattice Squares and Counting Dots

4. For each of the following lattice squares, count the lattice points on the inside of the square and the lattice points on the boundary of the square, including the 4 corners. Also find the square's area.



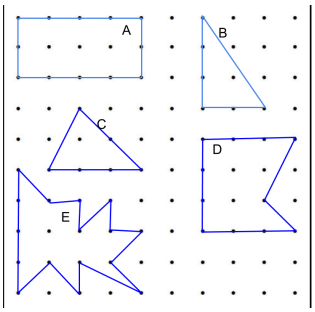
Square	Interior Dots (I)	Boundary Dots (B)	Area (A)
A			
B			
C			
D			
E			
F			
G			
H			
I			
J			

5. What do you notice about the number of dots and the area?

6. Does this pattern hold for other shapes, like lattice rectangles and lattice triangles?

Lattice Polygons

7. For each of these shapes, record
   (a) I = the number of lattice points (dots) inside the shape
   (b) B = the number of lattice points on the boundary of the shape
   (c) A = the area of the shape

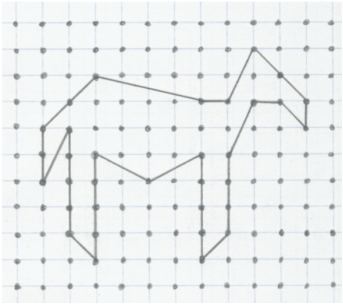


Shape	I	B	Area
A			
B			
C			
D			
E			
F			

8. Do you notice any patterns between area, I, and B?

9. If a shape has $I = 3$ and $B = 4$, can you predict its area?

10. Find the area of this horse.



11. How many ways can you make change for a dollar using only dimes, nickels, and pennies? Using dimes, nickels, pennies, and quarters? Hint: chart out the options of dimes and nickels on lattice paper.