**The Shoelace Theorem**

Suppose that a polygon is placed on a coordinate plane so that its coordinates are given by ($a\_{1, }b\_{1, }), (a\_{2,} b\_{2}), (a\_{3}, b\_{3} ) . . . (a\_{n}, b\_{n}) $listed in clockwise order. The area A of the polygon is

A = $\frac{1}{2} \left|(a\_{1}b\_{2 }+ a\_{2}b\_{3} + . . .+a\_{n}b\_{1}) - (b\_{1}a\_{2} + b\_{2}a\_{3}+. . . + b\_{n}a\_{1})\right|$ .

Suppose a polygon has vertices (1,1), (2,3), (4,3), and (3,1). Sketch it on your grid paper and find its area three different ways.

Why is this called the "shoelace" theorem?

Consider the square with vertices (0,a), (a, a+b), (a+b, b), (b,0). Sketch this square on your grid paper.

Find the area of this square.

What have you shown?