

Chapel Hill Math Circle

Intermediate Group

Operation Star¹
December 10, 2016

1. Let us define a new operation and call it "star." If we operate two elements, m and n , under star, we will call it " m star n " and denote it by " $m * n$." To operate m and n , draw m dots in a row and then draw n dots in a row below the first one. Now draw lines from every dot on the top row to every dot on the bottom row. $m * n$ is the number of single intersections of those lines. That is, when you draw a line, make sure it doesn't cross at an already existing intersection.

- a. What is $3 * 4$?

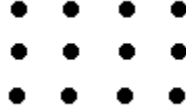


- b. What is $47 * 126$?

¹ Based on a workshop of the Triangle Math Teachers' Circle facilitated by Kim Johnson on December 3, 2016.

2. Let us define a second operation. We'll call it "pound" and denote the operation of m and n by $m \# n$. To operate m and n , draw m rows and n columns of dots. Now count the number of rectangles you can make with vertical and horizontal lines using the dots as corners. For instance, the diagram below shows the set up for $3 \# 4$.

a. What is $3 \# 4$?



b. What is $42 \# 123$?