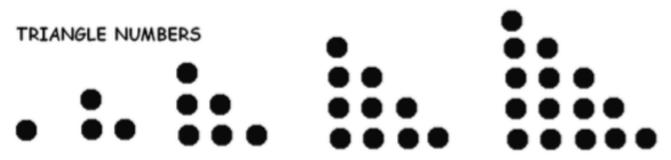# Weird Multiplication[1]

Warm-up

1. Complete this 6 by 6 multiplication table by writing the product of the number on the left and the number on the top in their square.

	1	2	3	4	5	6
1			. 3			
2						
3		6	9			
4						
5					25	30
6					30	36

2. The triangle numbers are the numbers that arise by arranging dots into triangles as follows.
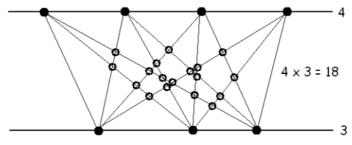

TRIANGLE NUMBERS

The first triangular number $T_1 = 1$, the second triangular number $T_2 = 3$, and the third trianglar number $T_3 = 6$.

   (a) What is T_4?
   (b) T_5?
   (c) T_6?
   (d) T_{10}?

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[1]Copied from James Tanton's THINKING MATHEMATICS!, Volume 1: Chapter 2, www.jamestanton.com

1   Intersection Math

Here's a new type of math called intersection math. To compute the product of two numbers, say four times three, draw two horizontal lines, place four dots on the top line, three on the bottom, and then connect each dot on the top line to each and every dot on the bottom line. The number of intersections that occur between the two horizontal lines is the product. (One must make sure that the dots are sufficiently spaced so that no point of intersection is crossed multiple times.) In intersection math, $4 \times 3 = 18$.

1. Is 3×4 also 18 in intersection math? If so, why?

2. What is 1×107 in intersection math?

3. Draw a six-by-six multiplication table for intersection math. What patterns do you notice?

	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

4. What's 201×16 in intersection math?

2   Rectangle Math

Here's another mathematical invention called rectangle math. To compute the product of two numbers, say, four times three, draw a four-by-three array of dots and count the number of (horizontal/vertical) rectangles one can draw with vertices on the grid. (Squares are also considered rectangles.)

$$\begin{matrix} \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet \end{matrix}$$

Here there are six 1-by-1 rectangles, three 1-by-2s, four 2-by1s, two 2-by-2s, two 3-by-1s, and one 3-by-2 , giving a total of eighteen rectangles: $4 \times 3 = 18$.

1. Is 3×4 also 18 in rectangle math? If so, why?

2. What is 2×10 in rectangle math?

3. Draw a six-by-six multiplication table for rectangle math. What patterns do you notice?

	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

4. What's 201×16 in rectangle math?

3   Ice Cream Math

Here's another kind of math called ice cream math. To compute the product of two numbers, say, four times three, imagine you have 4 flavors of ice cream in the freezer (Chocolate, Vanilla, Strawberry, and Mint) and three toppings (Peanuts, M&Ms, and Gummybears). You want to make a bowl of ice cream with exactly two different flavors of ice cream and exactly two different toppings. How many different ways could you do this?

For example, you could do:

CV — PM   CV — PG   CV — MG
CS — PM   CS — PG   CS — MG

List out all the ways.

1. Whtat is 4×3 in ice cream math?

2. What is 3×4? This means you have 3 flavors of ice cream and 4 different toppings, and you still have to use exactly 2 different flavors and 2 different toppings in your dessert.

3. What is 10×2 in ice cream math? This means 10 flavors of ice cream and 2 toppings and you have to use 2 flavors and 2 toppings as usual.

4. What is 1×6? You now have only 1 flavor of ice cream to work with but you are required to use 2 different flavors (plus 2 toppings). Is this possible? How many ways can you do this?

5. Draw a six-by-six multiplication table for ice cream math. What patterns do you notice?

	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

6. What's 201×16 in ice cream math?