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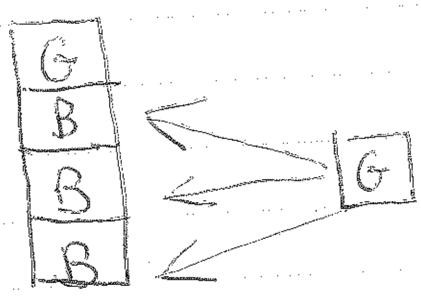
In this problem, I was introduced to a different way to think + go about creating towers.

We had two colors, green + blue, and we could build towers of four cubes.

To start this procedure we built all the possible towers that were four high and contained one green. There were four of these.

The next step was to build all of the possible towers with two greens out of the four we built with one green. We would build out of each tower ~~separately~~, for example the first tower had one green on the top. We could a another green to three other places, but we can not move the first green from its position on top.



After doing this with all four of the towers, we had twelve towers with two green. There were some duplications. Each new tower came in a pair, so there were really only six new towers.

Then, we took these six new towers and from each one, using the same method as before, we created towers four high with three green.

We created twelve towers, but, like before, there were duplicates. This time they came in groups of three. There were four new towers with three green in them.

At this point we started to see a pattern. From this pattern we created a formula. For towers with two green the formula looked like this, $\frac{4 \times 3}{2} = 6$, which stands for

$$\frac{\text{towers four high} \times \text{three towers per tower}}{\text{number of duplicates}}$$

Because of this formula, I was asked to make a prediction. My prediction was that we would

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multiply ~~by~~ four by one and divide by 4. This is because four towers with three green were created from the six towers with two green and each of these towers created one tower with four green. Because of this there were four duplicates so I would divide by four. $\frac{4 \times 1}{4} = 1$.
This was correct

Our final results were that for a tower with two greens there will be six $(\frac{4 \times 3}{2} = 6)$, for a tower with three greens there will be four $(\frac{6 \times 2}{3} = 4)$, and for a tower with all greens there will be one $(\frac{4 \times 1}{4} = 1)$.

$$(a+b)(a+b)(a+b)$$

$$(a^2+2ab+b^2)(a+b)$$

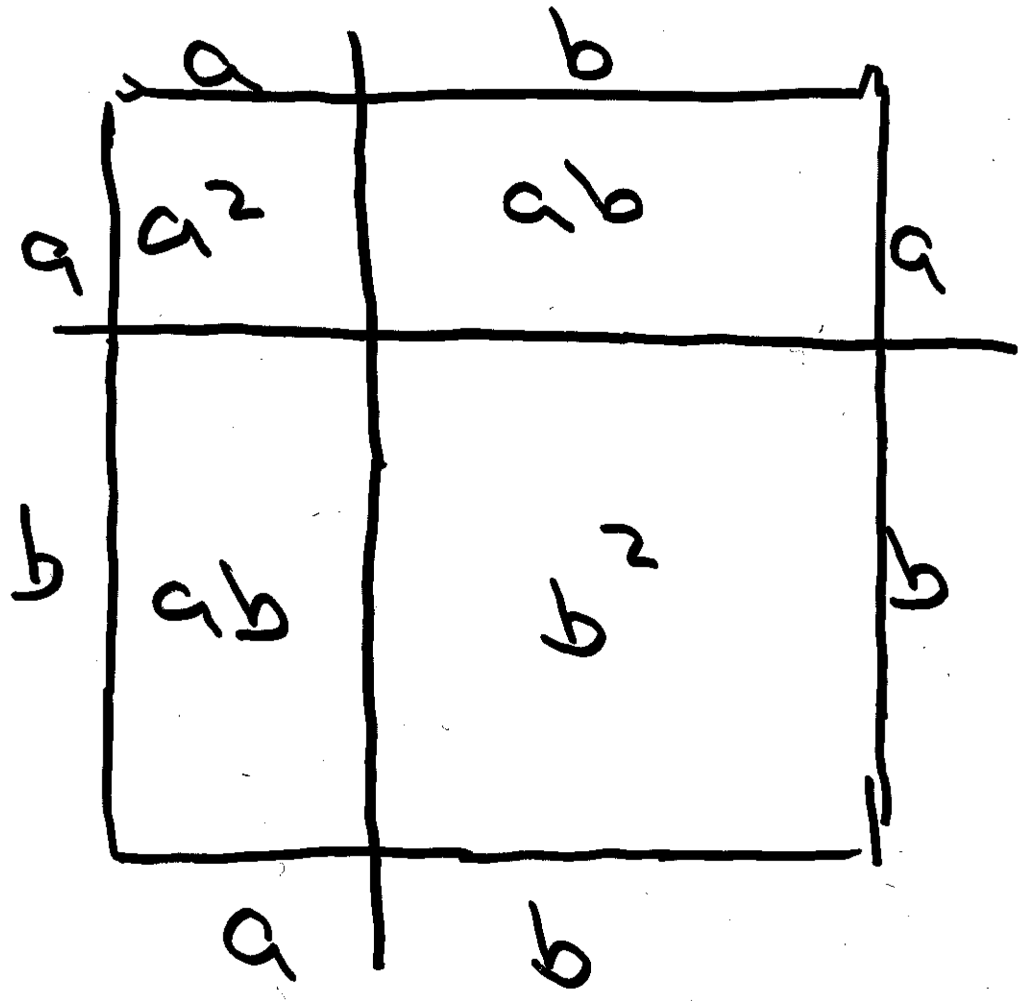
$$a^2(a+b) \quad 2ab(a+b)$$

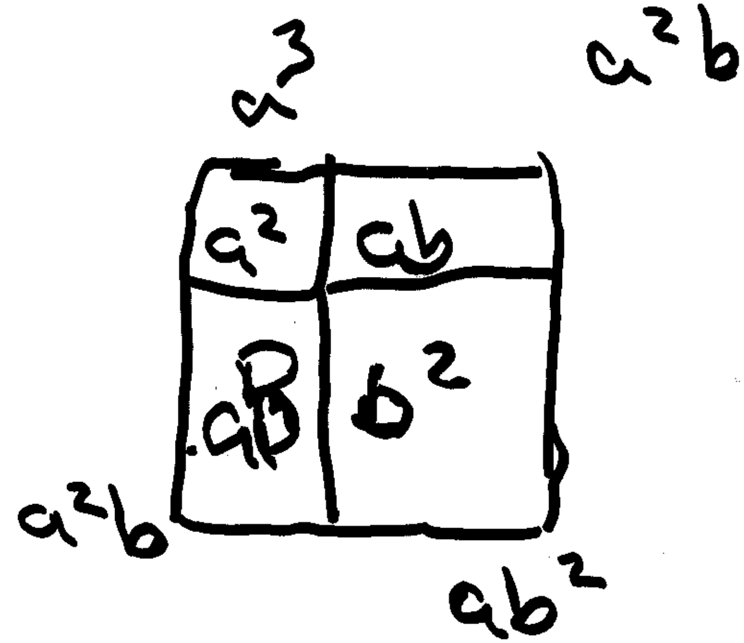
$$\to b^2(a+b)$$

$$\boxed{a^3 + a^2b + 2a^2b + 2ab^2 + ab^2 + b^3}$$

$$\boxed{a^3 + 3a^2b + 3ab^2 + b^3}$$

2


a
b
a
a^2
ab
a
b
ab
b^2
b
a
b



3^3

4

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for towers n high, moving from towers ~~one n at~~ $\binom{n}{1}$ to $\binom{n}{2}$, it would be $n \cdot (n-1)$.

n being to number of towers + the number of positions.

$$\frac{4 \times 3}{2} = 6$$

4 is number of positions or height of tower

3 is the number of spaces you can put a red in.

2 number of duplicates

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$$\frac{1 \cdot 5}{1} = 5$$

5 things taken 1 at a time

$$\frac{5 \cdot 4}{2} = 10$$

$$\frac{10 \cdot 3}{3} = 10$$

$$\frac{10 \cdot 2}{4} = 5$$

$$\frac{5 \cdot 1}{5} = 1$$

$$\frac{1 \cdot 6}{1} = 6$$

$$\frac{6 \cdot 5}{2} = 15$$

$$\frac{15 \cdot 4}{3} = 20$$

$$\frac{20 \cdot 3}{4} = 15$$

$$\frac{15 \cdot 2}{5} = 6$$

$$\frac{6 \cdot 1}{6} = 1$$

$$\binom{n}{1} = n$$

$$C^{n}_{1}$$

ℓ

n 1

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$$\frac{\cancel{4} \times 3}{2} = 6$$

$$\frac{6 \times 2}{3} = 4$$

$$4 \times 2$$

$$\frac{4 \times 1}{4} = 1$$

$$\frac{1 \times 4}{1} = 4$$

$C^4_2 + C^4_3 =$

C^5_3

$C^3_0 + C^3_1 = C^4_1$

C^m_n

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

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1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

1 6 15 20 15 6 1

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height 20 tall

tall 0 $= 2^0 = 1$

height n	total
1	$2 = 2^1$
2	$4 = 2^2$
3	$8 = 2^3$
4	$16 = 2^4$
⋮	
20	$= 2^{20}$
⋮	
n	$= 2^n$

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$$\frac{2^2}{2^2} = 1 = 2^{2-2} = 2^0$$

$$2^2 \times 2^{-2} = 4 \cdot \frac{1}{4} = 1$$

$$y = a^x$$

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