DEFINITION

$\mathbb{N}$

numbers you get by
- starting at 0
- repeated add'n of 1's

MULTIPLICATION

Example
Five 3's

Meaning
Repeated Add^{n}
$3+3+3+3+3$

EXPONENTIATION

Example
5th power of 3

Meaning
Repeated Mult^{n}
$3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$

PRODUCT OF POWERS $a^{x_1}a^{x_2} = a^{x_1+x_2}$

$a^5 a^2 = a^{5+2}$

Why: continued repeated mult^{n}

$aaaaa \cdot aa = aaaaaaa$

POWER OF POWER $(a^{x_1})^{x_2} = a^{x_1 x_2}$

$(a^3)^5$ $(a^5)^3$

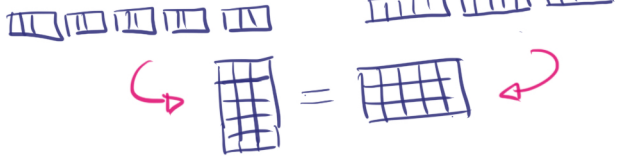
$aaa \cdot aaa \cdot aaa \cdot aaa \cdot aaa$ $=$ $aaaaa \cdot aaaaa \cdot aaaaa$

aaa
aaa
aaa
aaa
aaa

aaaaa
aaaaa
aaaaa

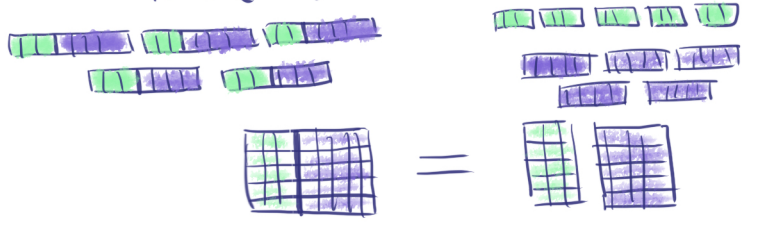
MULT^{n} IS COMMUTATIVE

Five 3's Three 5's



DISTRIBUTIVE PROPERTY

Five $(3+4)$'s Five 3's + Five 4's



POWER OF PRODUCT $(ab)^x = a^x \cdot b^x$

$(ab)^5$ $a^5 b^5$

ab ab ab ab ab aaaaa bbbbb