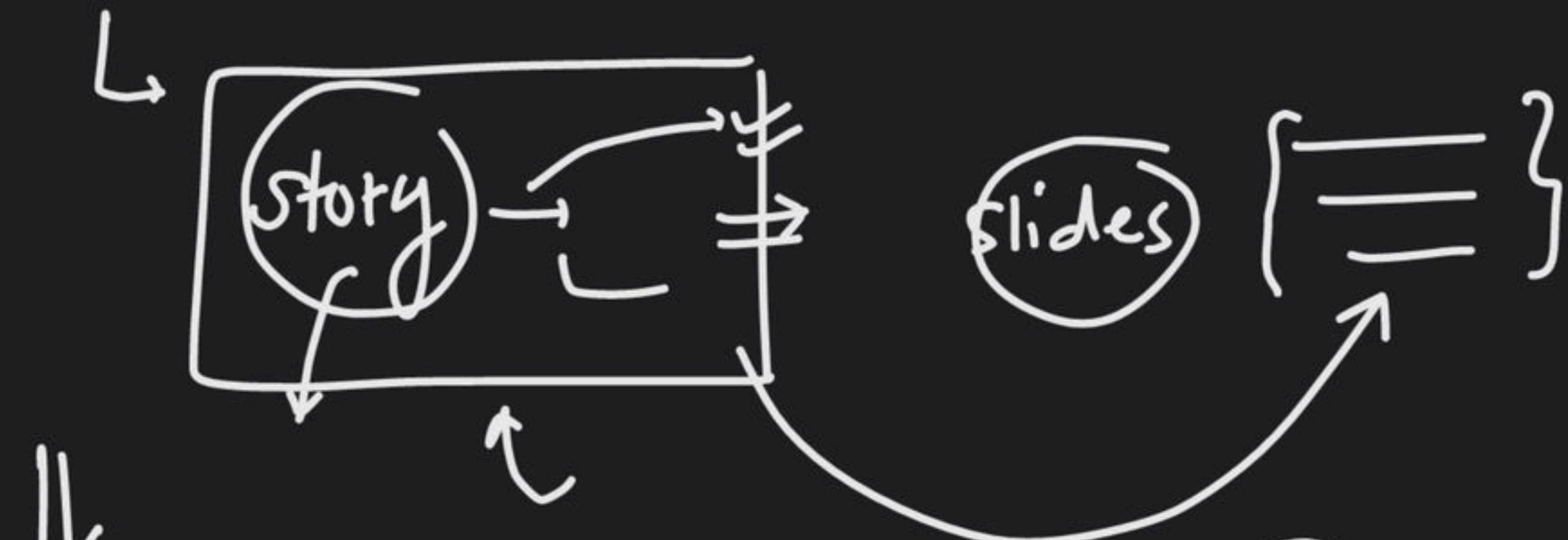
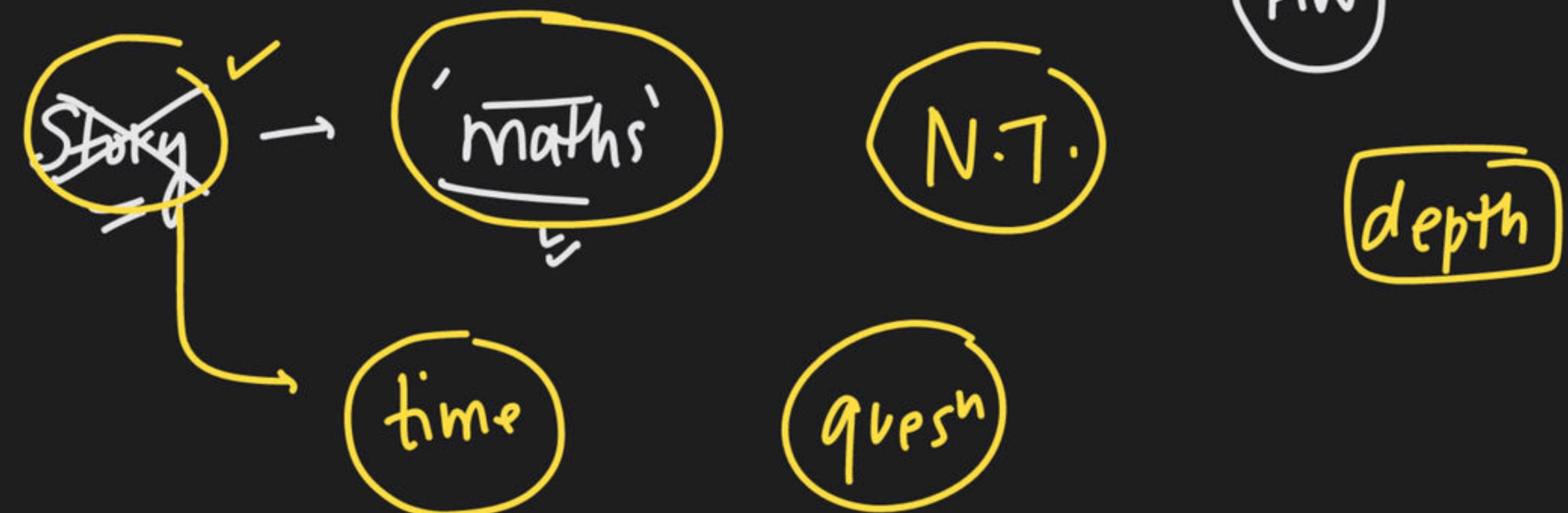


Higher Arithmetic & Elementary Number Theory

Course on Mathematics for JEE 2026

① Notes

②



I.S. - L,-

$$(2+3)(3+5+2)(7+8)(16+3+2+1)$$

$$(2 \cdot 3 + 2 \cdot 5 + 2 \cdot 2 + 3 \cdot 3 + 3 \cdot 5 + 3 \cdot 2) (7+8)$$

$$(2 \cdot 3 \cdot 7 + 2 \cdot 5 \cdot 7 + \dots + 2 \cdot 2 \cdot 7) - (2 \cdot 3 \cdot 8 + 2 \cdot 5 \cdot 8 + \dots + 2 \cdot 2 \cdot 8)$$

= Sum of product of
all possible numbers $\square \cdot \square \cdot \square$



7 x 5 x 6

7 x (y)

abc

$$=acb$$

- bac

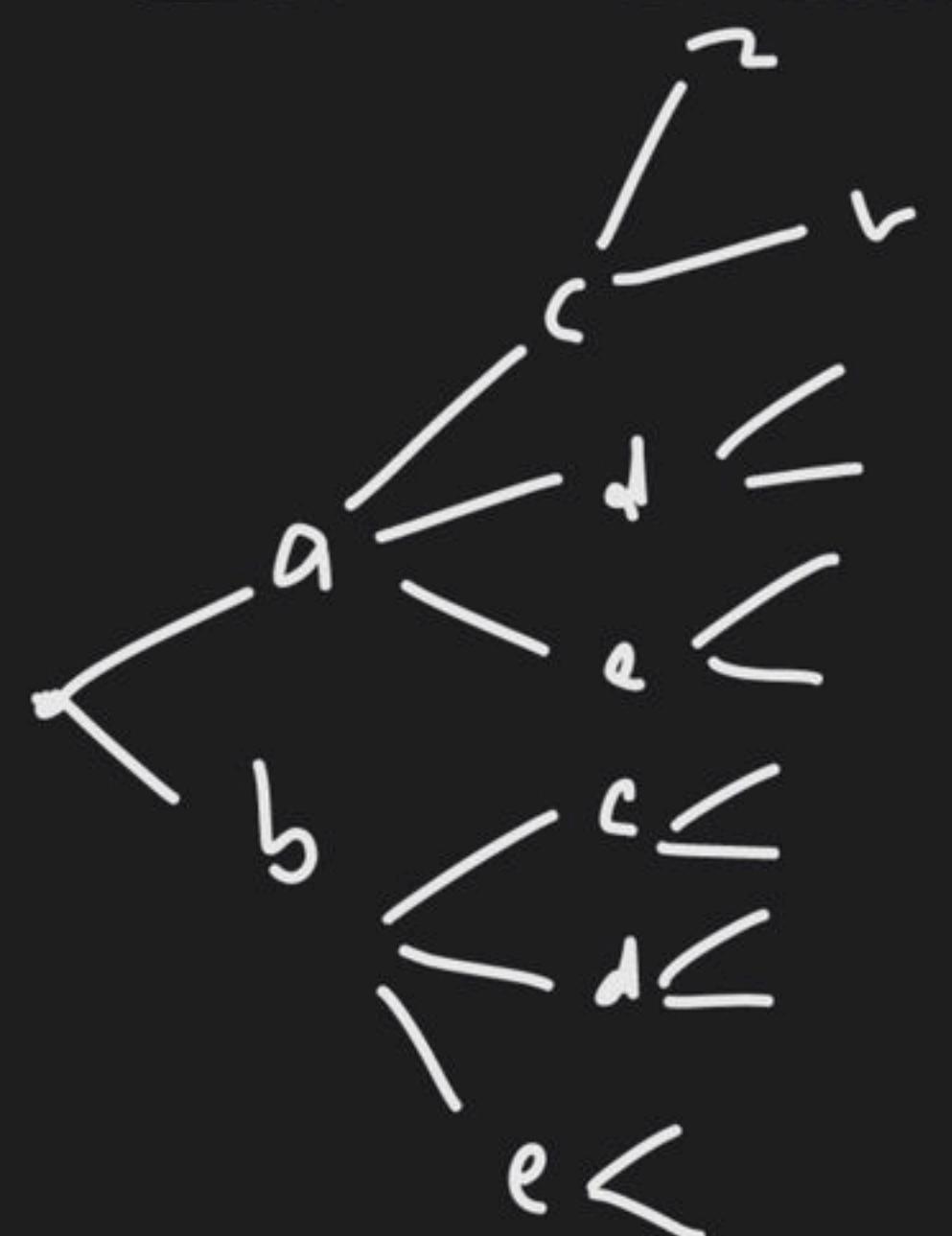
- b c a

2

$$\begin{aligned}
 & \frac{(a+b)(c+d+e)(z+w)}{m=0} \xrightarrow{\text{f2}} \\
 & = \left(acz + acw + adz + adw + ae z + ae w \right. \\
 & \quad \left. - bcz - b cw - - - - - \right)
 \end{aligned}$$

↑
terms

thinking)



$(a+b+c+\dots+z)(\underbrace{\hspace{10cm}}_{\text{numbers}})(\underbrace{\hspace{1cm}}_{\text{26 brackets}})(\underbrace{\hspace{1cm}}_{\text{26 brackets}})$

$(a_1+a_2+a_3+\dots+a_{n_1})(b_1+b_2+\dots+b_{n_2})(c_1+c_2+\dots+c_{n_3})\dots$

$a_{11} a_{12} a_{13} \dots A$

B

C

A₃

$\frac{z}{z}$

$\dots A_{26}$

$$= \left(\underbrace{a_1 + a_2 + \dots + a_{n_1}}_{a_1} \right) \left(\underbrace{a'_1 + a'_2 + a'_3 + \dots + a'_{n_2}}_{a'} \right) \left(a''_1 + \dots + a''_{n_3} \right) \dots$$

$$= \left(\underbrace{a_{11} + a_{12} + a_{13} + \dots + a_{1n_1}}_{\text{m-brackets}} \right) \left(\underbrace{(a_{21} + a_{22} + a_{23} + \dots + a_{2n_2})}_{a} \right) \dots$$

m-brackets

$$\begin{matrix} n_1 & n_2 & n_3 & \dots & n_m \\ / \backslash / \backslash / \backslash \dots / \backslash \end{matrix}$$

$$= \left(\sum_{j=1}^{n_1} a_{1j} \right) \left(\sum_{j=1}^{n_2} a_{2j} \right) \left(\sum_{j=1}^{n_3} a_{3j} \right) \dots \left(\sum_{j=1}^{n_m} a_{mj} \right)$$

$$= \left(\sum_{j=1}^{n_1} a_{1j} \right) \left(\sum_{j=1}^{n_2} a_{2j} \right) \left(\dots \right) \cdot \left(\sum_{j=1}^{n_m} a_{mj} \right)$$

प्रत्येक पन्ने
2622

$$= \sum_{j=1}^n a_{0j} \quad \Sigma a \quad \Sigma a$$

$$\left(\sum_{j=1}^{n_i} a_{ij} \right), \quad i = 1, 2, 3, \dots, m$$

$$\sum_{j=1}^{n_2} a_{2j}$$

$$\sum_{j=1}^{n_m} a_{mj}$$


$$A = \begin{matrix} & \vdots & & \vdots \\ & a_{1,1} & \cdots & a_{1,n_2} \\ \vdots & & \ddots & \\ a_{n_1,1} & \cdots & a_{n_1,n_2} & \end{matrix}$$
$$\sum_{j=1}^{n_2} a_{1,j}$$
$$\sum_{i=1}^{n_1} a_{i,1}$$



$$\sum_{j=1}^{n_1} a_{1j} + \sum_{j=2}^{n_2} a_{2j} + \dots + \sum_{j=m}^{n_m} a_{mj}$$

$A_1 \times A_2 \times A_3 \times \dots \times A_n$

$$\sum_{i=1}^m \left(\sum_{j=1}^{n_i} a_{ij} \right), \quad i = 1, 2, 3, \dots, m$$

Tough

math

Calculator

sigma

$$\sum_{i=1}^h \alpha_i = \alpha_1 + \alpha_2 + \alpha_3 + \dots + \alpha_h$$

hak ate

$$\prod_{i=1}^h \alpha_i = \alpha_1 \cdot \alpha_2 \cdot \alpha_3 \cdot \alpha_4 \cdot \dots \cdot \alpha_h$$

pie

 α_1 α_2
 α_3 α_4
 α_5 α_6
 α_7 α_8
 α_9 α_{10}

$$\left[\begin{array}{c} m \\ \hline \end{array} \right] \left(\sum_{j=1}^{n_i} a_{i,j} \right)$$

point

matrices

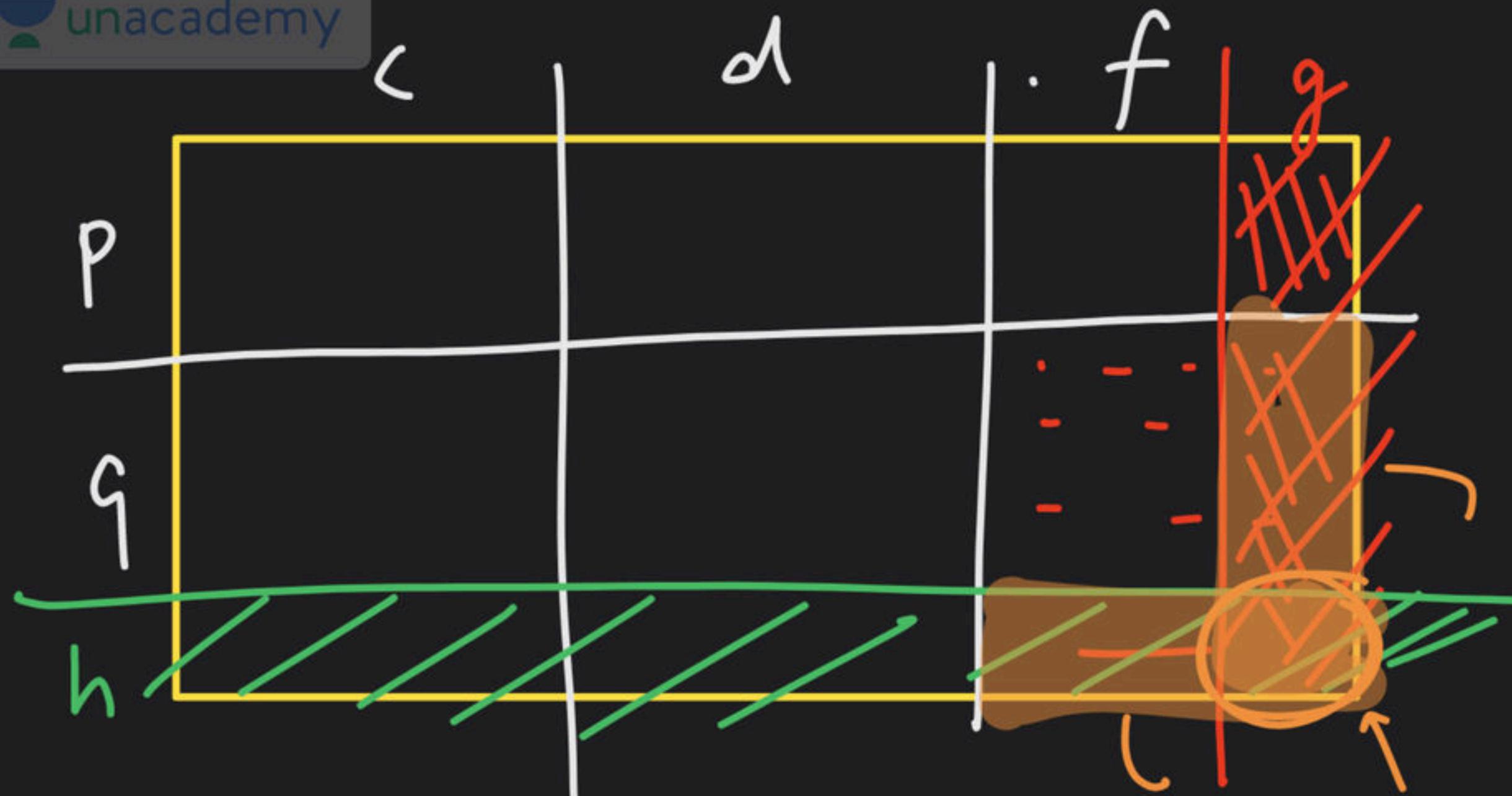
 $A(B C)$

pressure

②

tough

balance



4
0 0 0 0
3 0 0 0 0
0 0 0 0 0

4
3
0 0 0 0 0

$P (-g)$
 $= -Pg$

-ve

?

$a \cdot b$

$$(P + g_h) (c + d + f - g)$$

$$pc + pd + \cancel{pf} + tc + gd + gf - ch - dh - gg - gh$$

$$(p + q - h)(c + d + f - g)$$

$$++ = +$$

$$\begin{array}{ll} + - & - \\ - + & - \end{array}$$

$$\begin{aligned}
 & pc + pd + pf - pg + qc + qd + qf - qg + \\
 & - ch - dh - fh + gh
 \end{aligned}$$

$$-- = +$$

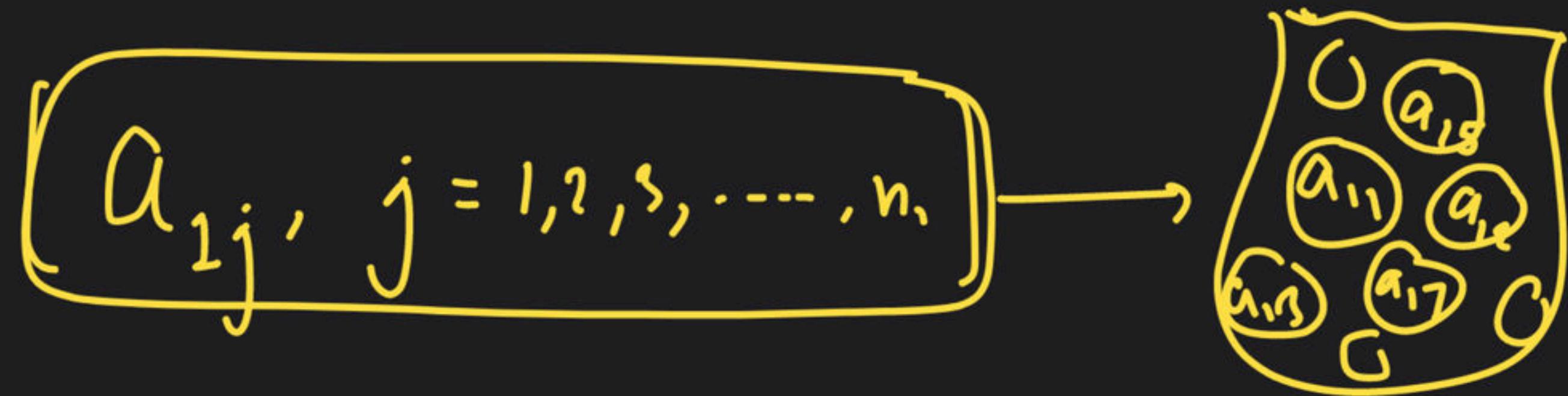
$$-- | +$$

$$(p + q_h)(c + d + f - g)$$

$$(p c + p d + p f +) - q_p$$

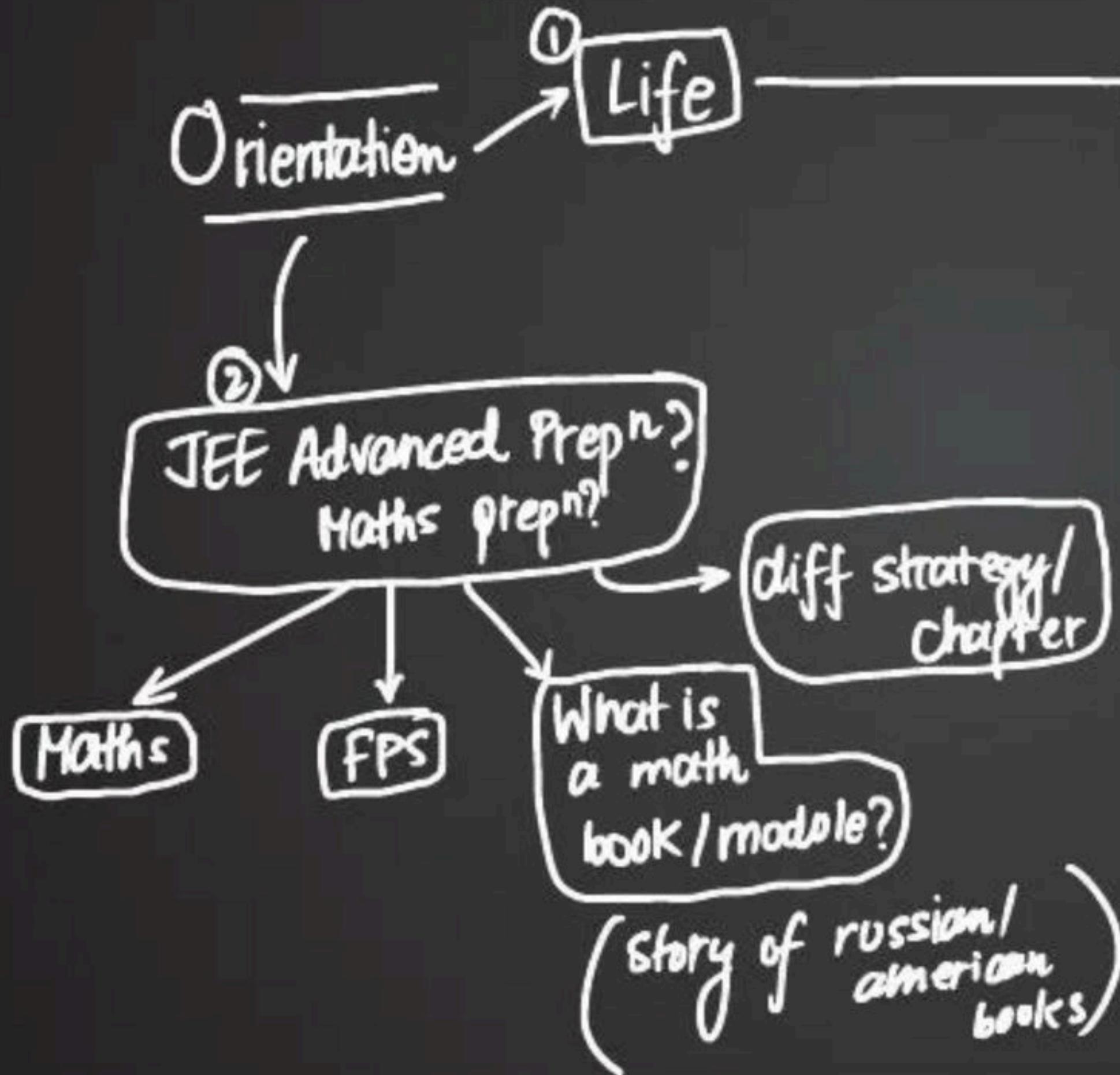
$$\begin{aligned}
 & qc + qd + qf - fh + qg + gh \\
 & - ch - dh - gg
 \end{aligned}$$

$$\sum a_{ij}$$



$$(a_{11} + a_{12} + a_{13} + \dots + a_{1n_1}) = \sum_{j=1}^{n_1} a_{1j}$$

JEE ADVANCED 2026



AN EYE OPENER FOR JEE/NEET! This is how to stop planning and actuall...

2.2 lakh views · 1 year ago

Choice >>> Gyaan
(understanding) (knowledge)

2.5hr - 2hr] → Lect + discn

↓
morning = Quick revise + HW

② Notes = Deep focus

"Likhna"

(4-5 days practice)

"NO RECORDINGS"

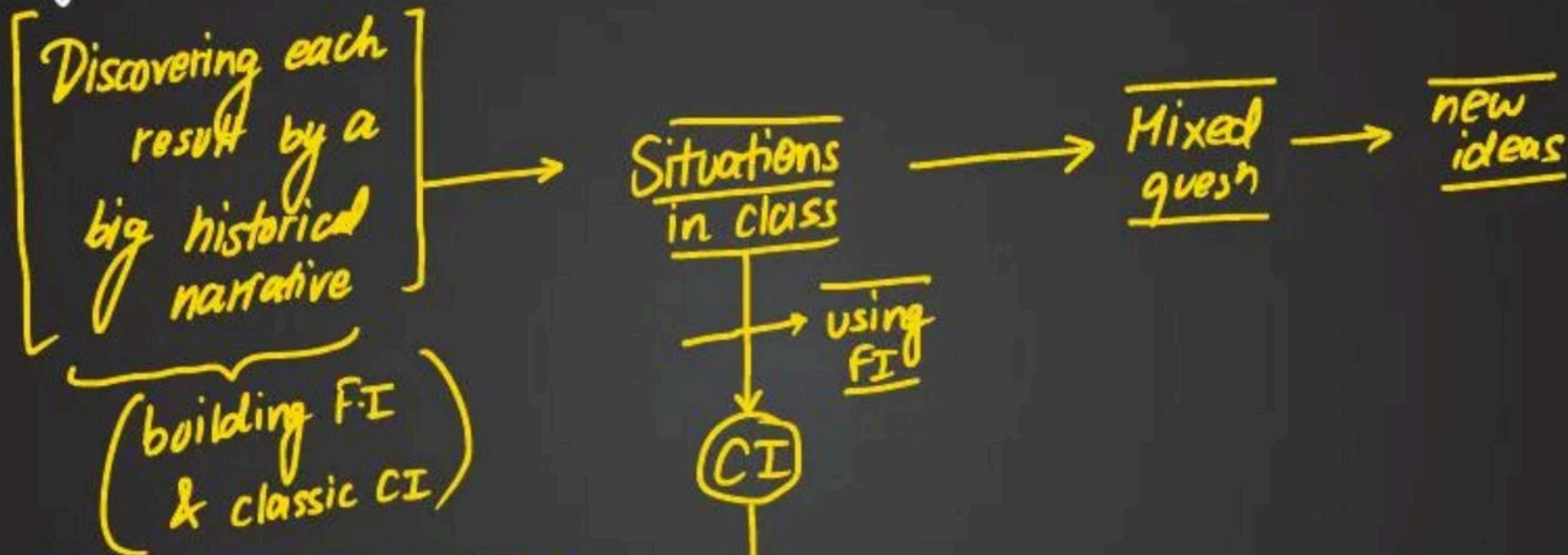
~~recording~~ (your own handwritten notes)

③ Group later :→ eligibility (7 days)

④ Books

A problem

My teaching methodology =



{ NO CHAPTERS
NO TOPICS
NO HEADINGS }

its all a FLOW...

My teaching methodology =

any math problem
(in JEE syllabus)

10
Skills

- ① Algebraic / Exp-log manipⁿ
- ② Trigo manipⁿ
- ③ Geometric transfⁿ
- ④ Calculus version (L,D,I) manipⁿ
- ⑤ Matrix manipⁿ
- ⑥ Logic & Proof = Attentive eyes
- ⑦ Number Theoretical skills
- ⑧ Information processing
- ⑨ Conceptual applications → toughest / easiest
- ⑩ Counting

FORGET EVERYTHING!

2.5 million
years
ago



You came out as
first baby!

I

Kuch na kuch try karte raho bas!

~ pen chatte rehne chahiye!

~ until you see the light from
the end of the tunnel

I

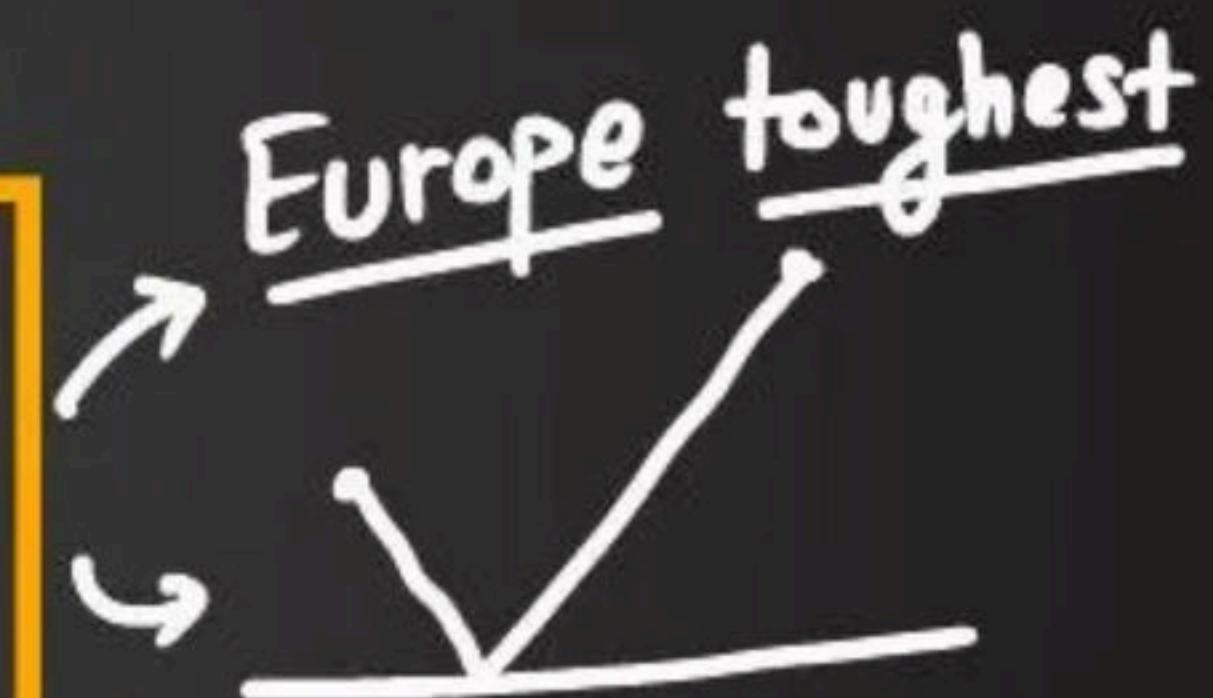
HUNGER TO SOLVE!

Do you have that!?

II

Expand your scope!

↳ Drop the resistance
~ optionless!
choose it!

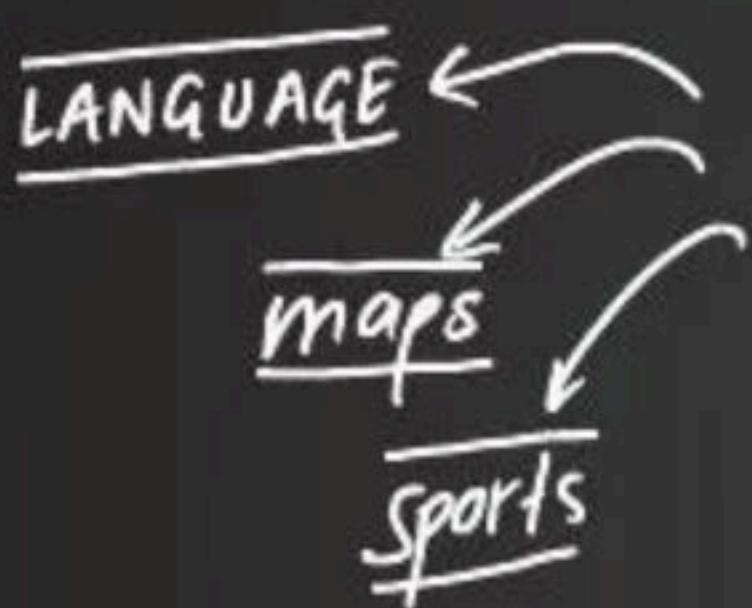


IMO 1996

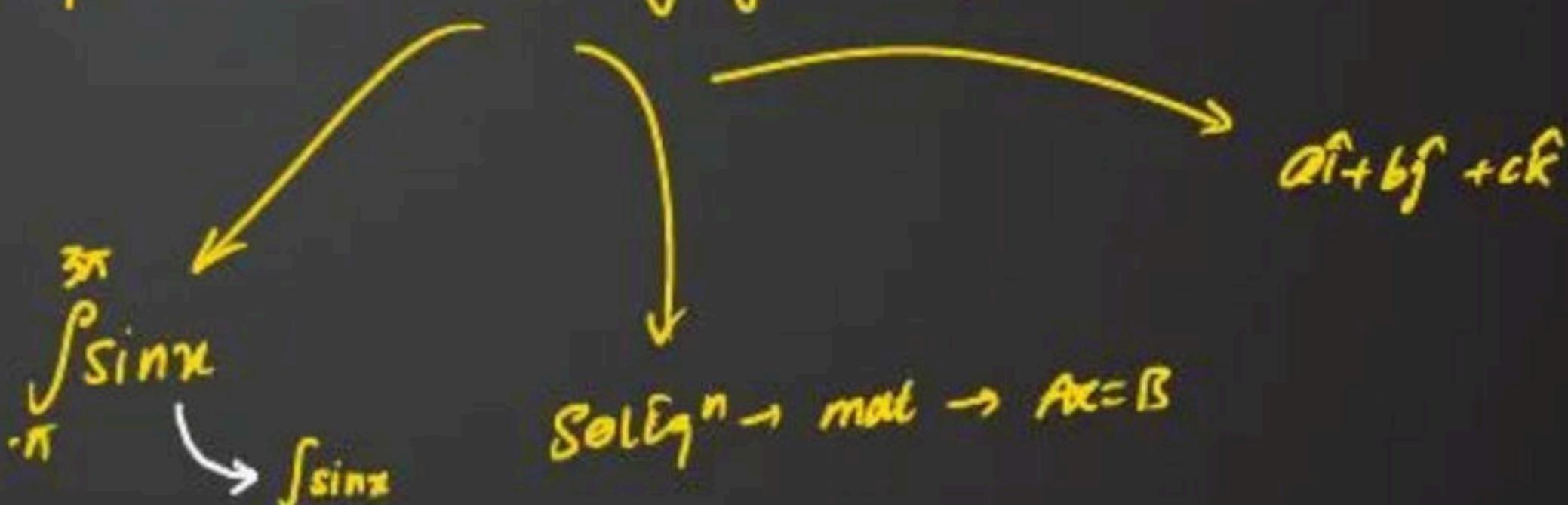
IV

SUBSTITUTION

We substitute / represent a complex situation , & then work over that representation instead!



↳ All maths structures are just very nicely made representations , very good information carriers!



0 0
0
0 0

4

0 0
0
0

3

0 0
0
0 0
0 0 0

0 0
0 0
0 0

① Number sense →

② gets better by patterns



ISHANGO BONE (18000 BC)

(V)

JOY ~ useless playing
with things



Problem
Solving

(VI)

PORTABILITY

- Substitute the substitutions further to carry uncomfortable substitutions in your mind comfortably!
- There shouldn't be loss of information just to make it portable!
e.g. rocks falling on the way
 $x^2 = t \rightarrow t \in [0, \infty)$

$$f(n) = \frac{\sum_{k=0}^n \sin\left(\frac{k+1}{n+2}\pi\right) \cdot \sin\left(\frac{k+2}{n+2}\pi\right)}{\sum_{k=0}^n 2\sin^2\left(\frac{k+1}{n+2}\pi\right)}$$

(JEE Advanced 2019)



$$\begin{aligned}
 f(n) &= \frac{\sum_{k=0}^n \sin\left(\frac{k+1}{n+2}\pi\right) \cdot \sin\left(\frac{k+2}{n+2}\pi\right)}{\sum_{k=0}^n 2\sin^2\left(\frac{k+1}{n+2}\pi\right)} \\
 &= \frac{\sum_{k=0}^n \cos\frac{\pi}{n+2} - \cos\left(\frac{2k+3}{n+2}\pi\right)}{\sum_{k=0}^n 2\sin^2\left(\frac{k+1}{n+2}\right)\pi} \\
 &= \frac{(n+1)\cos\frac{\pi}{n+2} - \frac{\cos\left(\frac{n+3}{n+2}\pi\right)\pi \cdot \sin\left(\frac{n+1}{n+2}\pi\right)}{\sin\frac{\pi}{n+2}}}{\cos\pi \cdot \sin\left(\frac{n+1}{n+2}\right)\pi} \\
 &= \frac{(n+1)\cos\left(\frac{\pi}{n+2}\right) + \cos\left(\frac{n+3}{n+2}\pi\right)}{(n+1)+1} \\
 &= \cos\left(\frac{\pi}{n+2}\right)
 \end{aligned}$$

Back to the bone!

it may fall down
during the path!

III

BREAKING
INTO
KNOWN CHUNKS!

Grouping

t-t-c-c-c

Rhythm

↳ we can remember
music
dance

The three tribes

Hand people

Banana people

Tree people

thump-thump-clap-clap →

~ mentally ~

Let a_1, a_2, a_3, \dots be a sequence of positive integers in arithmetic progression with common difference 2. Also, let b_1, b_2, b_3, \dots be a sequence of positive integers in geometric progression with common ratio 2. If $a_1 = b_1 = c$, then the number of all possible values of c , for which the equality $2(a_1 + a_2 + \dots + a_n) = b_1 + b_2 + \dots + b_n$ holds for some positive integer n , is

(JEE Advanced 2020)

$$c = \frac{2^n - 2^{n-1}}{2n^2 - 2n}$$

$$n \in \mathbb{N} \rightarrow c \in \mathbb{N}$$

Let the set $C = \{(x, y) \mid x^2 - 2^y = 2023, x, y \in \mathbb{R}\}$. Then

$$\sum_{(x,y) \in C} (x + y) \text{ is equal to } \dots$$

(JEE Mains 2024)



You are a Banana tribesman with 'la-la-la bananas' to trade for tools and wooden beads. Each tool costs ~~thump-thump-clap-clap bananas~~, and a single banana is worth ~~two wooden beads~~. After buying three tools (& eating one banana for launch), how many beads (in Tree language) can you afford?

Answer

.



18000 years ago → ICE AGE → Caves

Agriculture ← Wheat!! ← lot of edible food ✕

First time in human history,
HUMANS SETTLED DOWN! (Near the rivers)

VIII

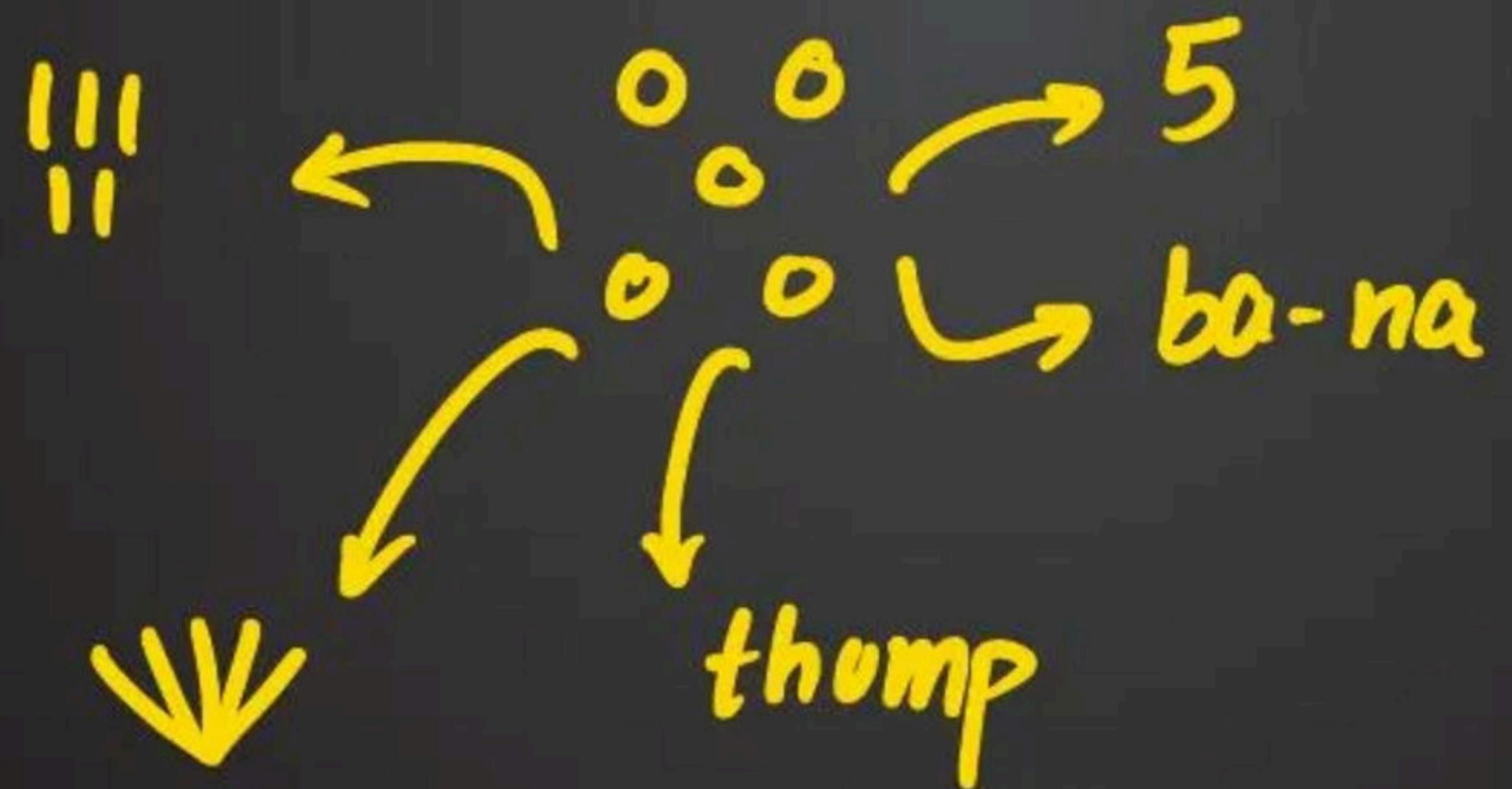
Try to observe,
what's "constant", "unchanging",
"stable" etc. in a
constantly changing, variable,
seemingly "impossible" thing!

नियम नियम नियम नियम
नियम नियम नियम नियम ॥

v/s

नियम नियम नियम नियम
नियम नियम नियम नियम ॥



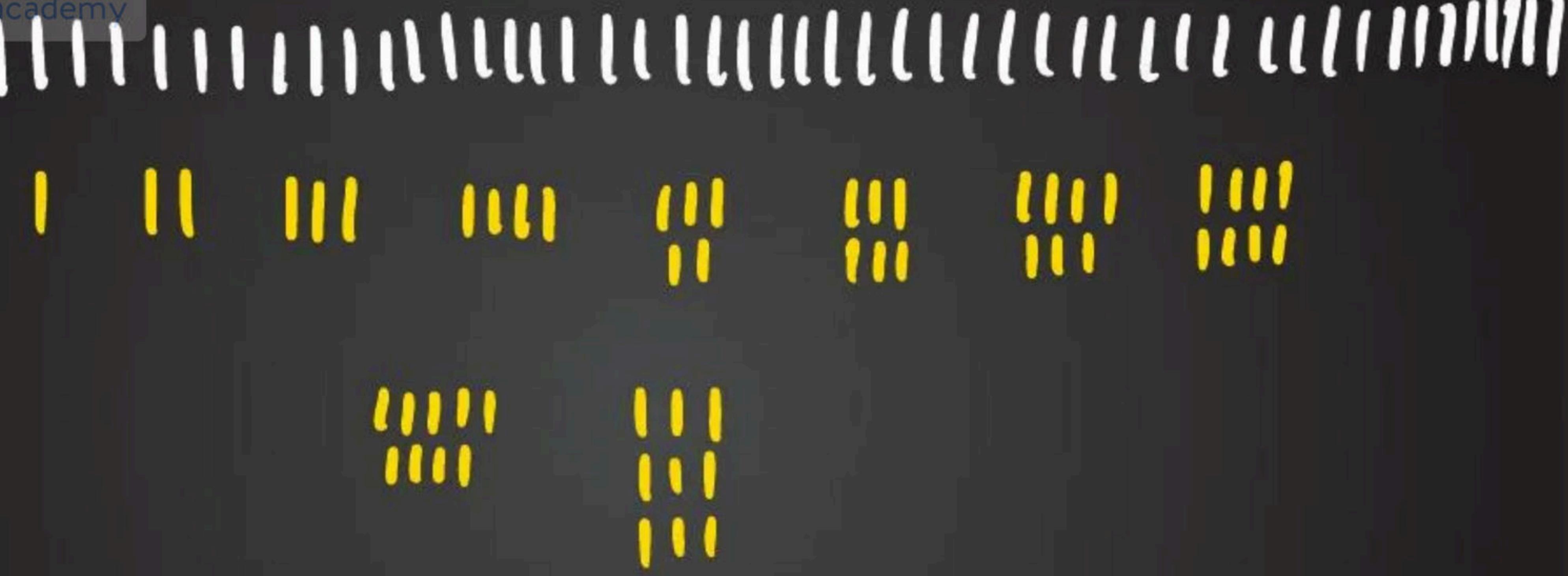


★ Wheat = ⚡⚡PPP PPP II

Rice = ⚡ PPPP PPP III

Barley = PPP III

marked
value
system
↓
order X



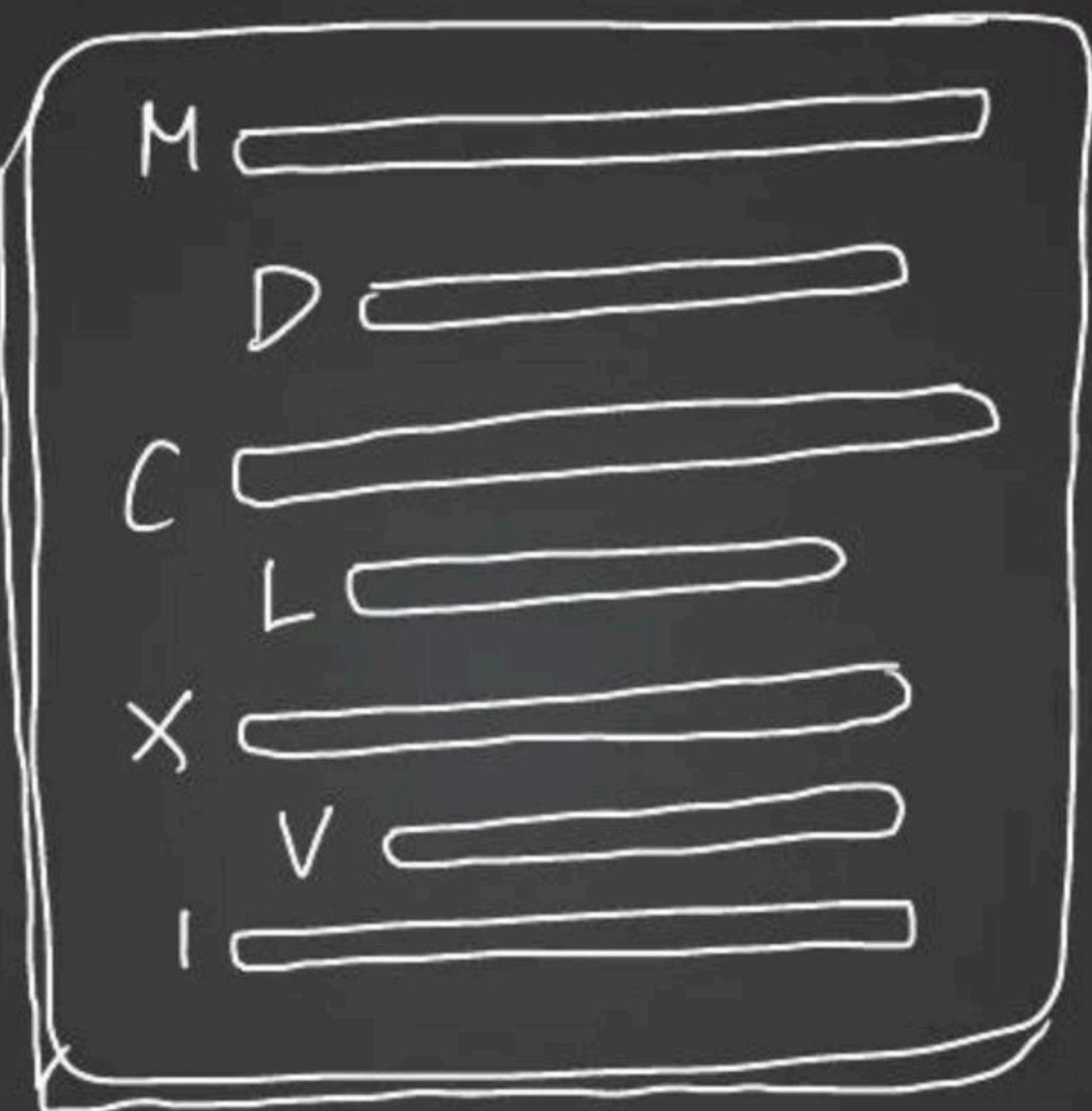
 Roman Tabula:
(abacus)

order:

MMDC XXXV flasks
of oil

⇒ MCCCLXIII

⇒ MCC LXXIII



throughout
the world

INDIA!

Number language

Portable
in our
heads!

easy & fast
to write

grouping size

(too
small)

(too
large)

Abacus / Calculator

portable fragile

১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯

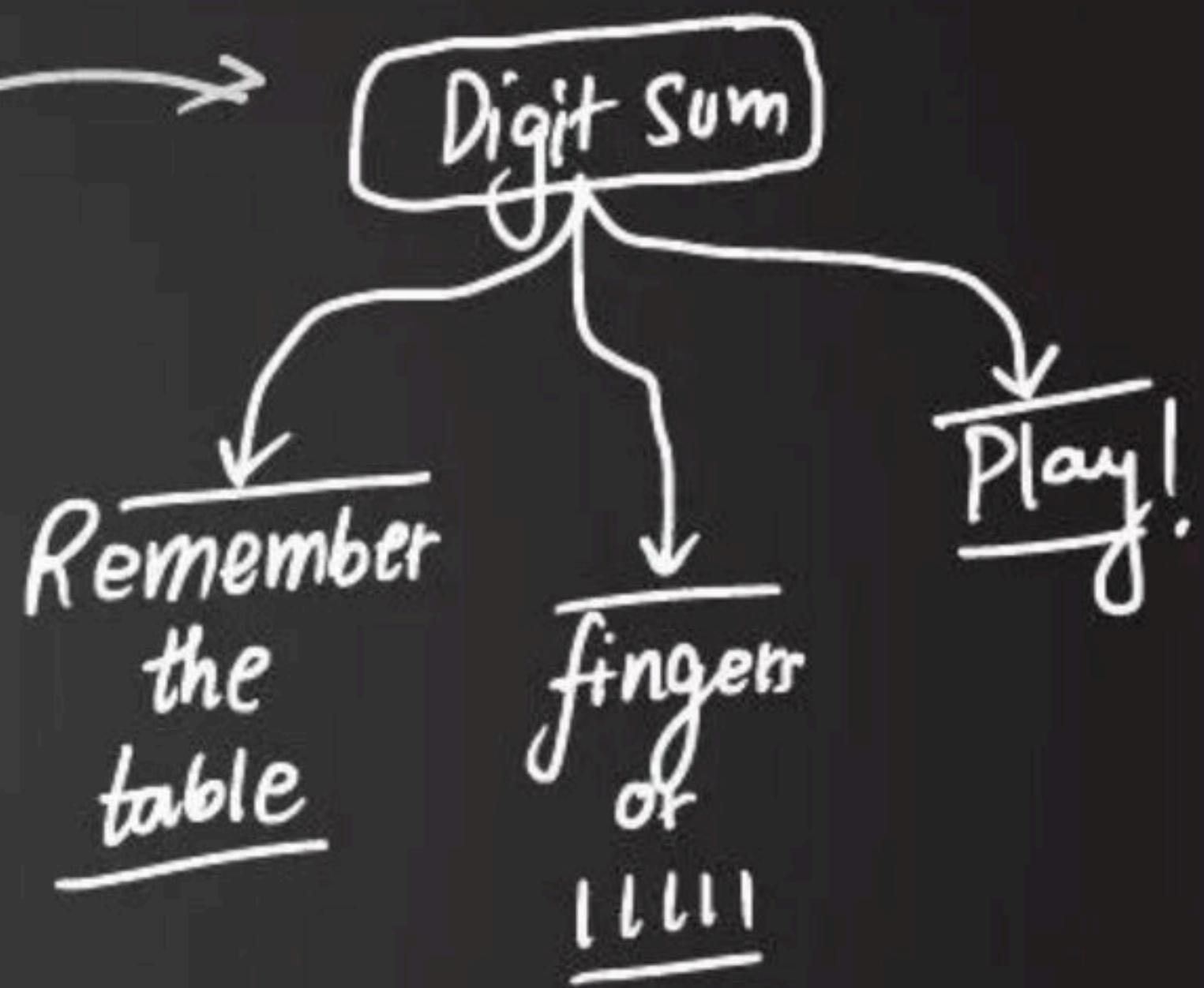
↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

১ ২ ৩ ৪ ৫ ৬ ৭ ৮ ৯



5	6	4	2
9	2	7	

digit diff



$$8 + 6 + 7 + 2 + 4 + 3$$

fudge the bars!!

+	1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10	11
2	3	4	5	6	7	8	9	10	11	12
3	4	5	6	7	8	9	10	11	12	13
4	5	6	7	8	9	10	11	12	13	14
5	6	7	8	9	10	11	12	13	14	15
6	7	8	9	10	11	12	13	14	15	16
7	8	9	10	11	12	13	14	15	16	17
8	9	10	11	12	13	14	15	16	17	18
9	10	11	12	13	14	15	16	17	18	19
10	11	12	13	14	15	16	17	18	19	20

13 =

how
to
handle
this?

also +1

2	7	7	4
7	2	5	

8193763794 723654



Can handle anything!

Doubling!

No one comes even close to
Indians in this!

Recipe: ||| packets

Double :

Double :

7 times:

} other worlds

I
think in roman!?

Indians analysed some patterns:

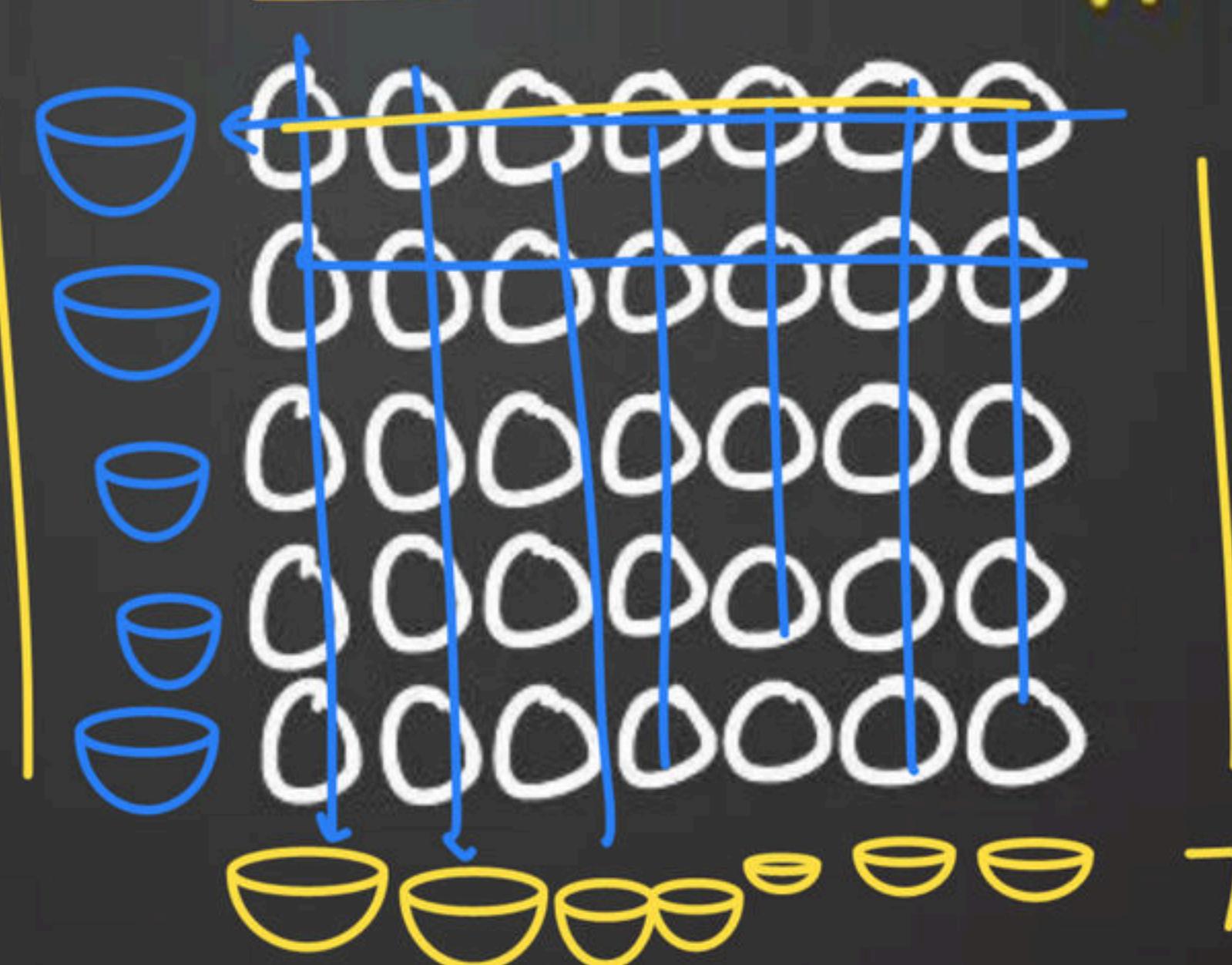
①

$$5+5+5+5+5+5+5 = 7 \times 5$$

counter

diff things

7 apples in 5 baskets \longleftrightarrow 5 apples in 7 baskets

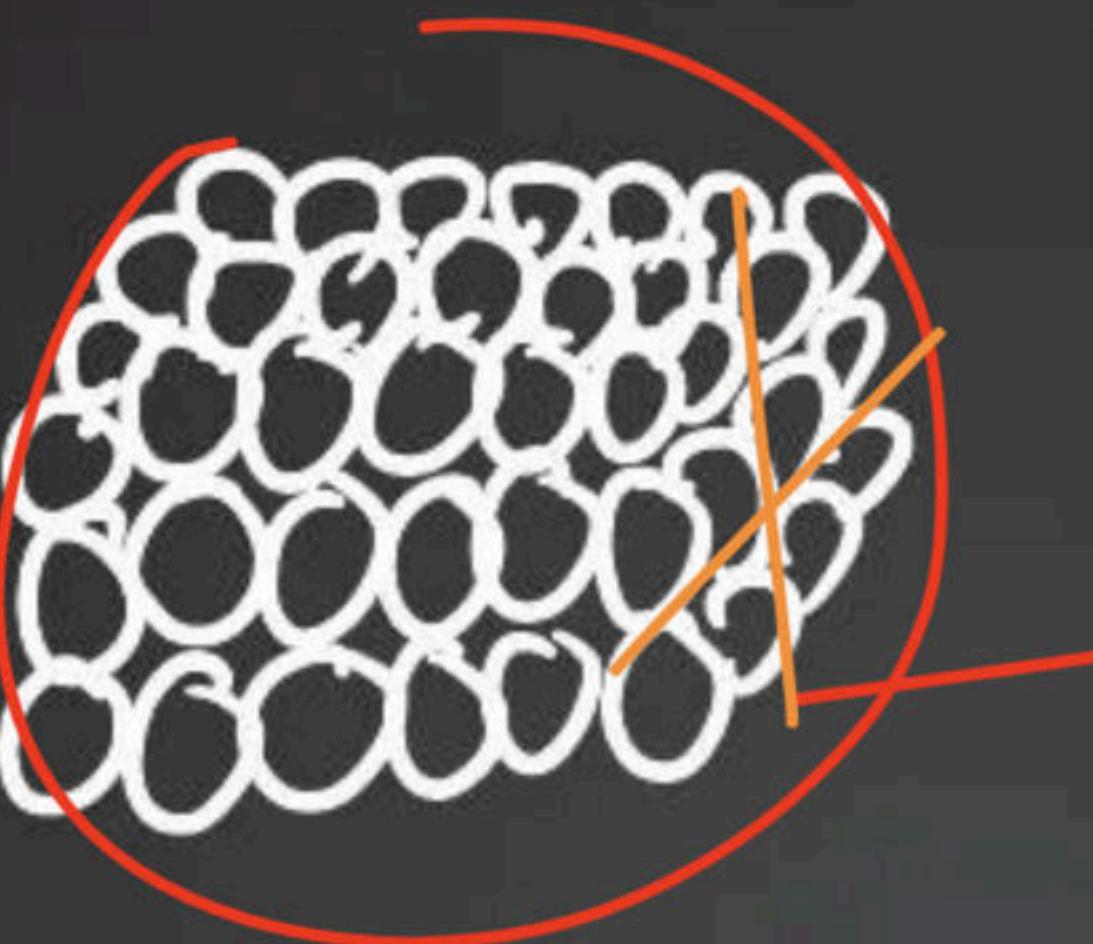


$$(_) \times (_)$$

$$5 \times 4$$

$$\underline{7 \times 5} = \underline{5 \times 7}$$

$$\begin{aligned} & (\underline{7 \times 5}) \times 10 \\ &= (5 \times \underline{7}) \times 10 \\ &= \boxed{7 \times (5 \times \underline{\underline{10}})} \\ &= (7 \times 10) \times 5 \end{aligned}$$



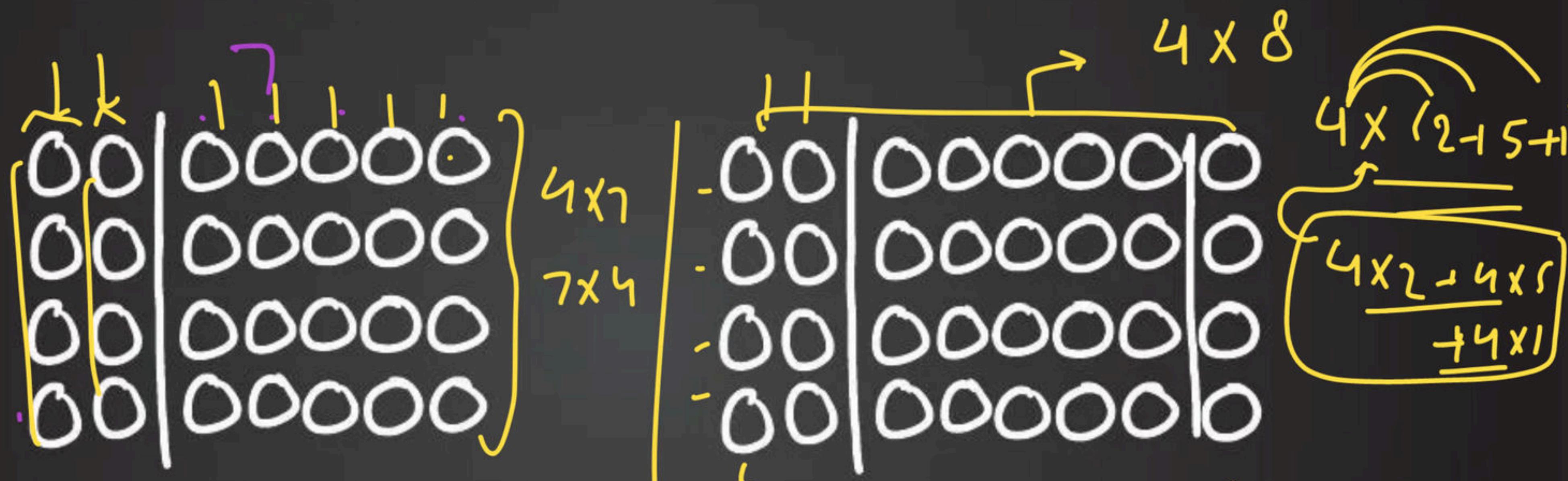
$$(6 \times 4 \times 3) \times 11$$

$$7 \times 8 \times 2 \times 5 \times 6$$

II 5 apples + 3 apples = $(5+3)$ apples = 8 apples

$$5 \text{ thirty sevens} + 3 \text{ thirty sevens} = (5+3) \text{ t.s} =$$

$$5 \times 37 + 3 \times 37 = 8 \times 37$$



$$4 \times 2 + 4 \times 5 = 4 \times 7$$

$4 \times (2+5)$

$$2 \times 4 + 5 \times 4 = (2+5) 4 = 7 \times 4$$

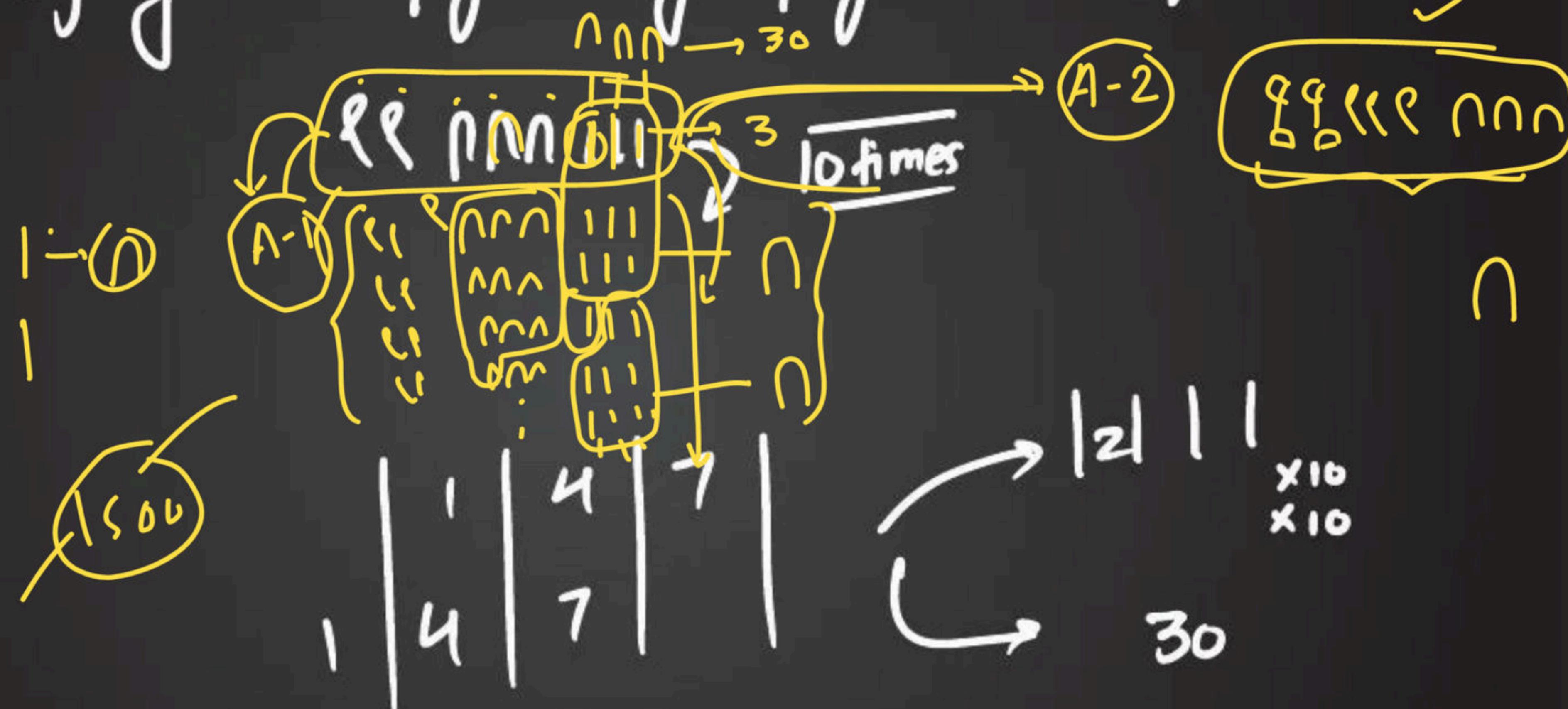
000	0000000000	(2 + 3)(3 + 1)
000	0000000000	
600	0000000000	
000	0000000000	
000	0000000000	

you can chop the way you wish to!

()C LC)C)

III

If you multiply the grouping size itself?



$$200 \times 30$$

$$= 2 \times 3 \times 10 \times 10 \times 10$$

1	4	7	4	1	7	0	0	7	0
---	---	---	---	---	---	---	---	---	---

Simple

20000
x 300

6 000000

10^u 6×10^6

3 | 10^u | ③ | 10²

2 | 6 | ② | 2

2 | ③ | 2 | 2

2 | ② | 10⁴

'4' shift

5000
x 76

350000

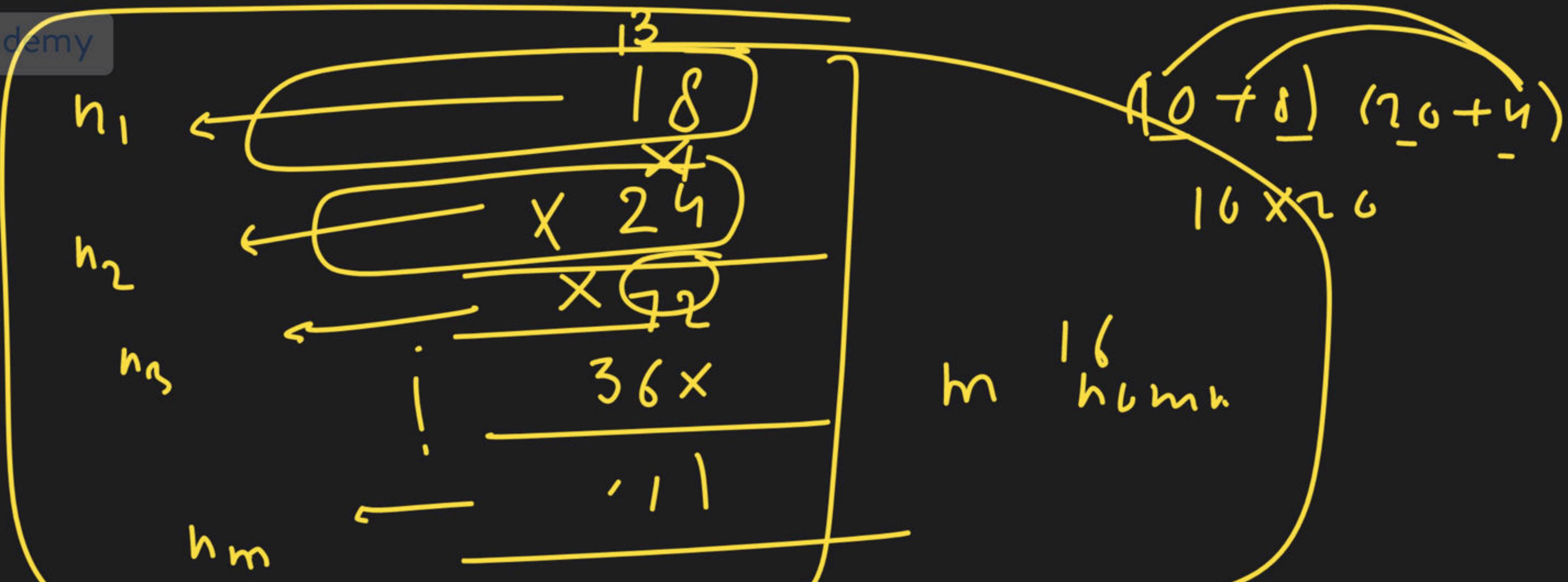
$$(2 \times 10 \times 10 \times 10 \times 10) \times (3 \times 10 \times 10)$$

173 x 254

$$(100 + 15 + 3)(200 + 50 + 4)$$

$$\begin{array}{r} 173 \\ \times 254 \\ \hline \end{array}$$

A hand-drawn diagram on a grid background. The diagram features a large rectangle divided into four quadrants by a cross. In the top-left quadrant, there is a rounded rectangular shape containing several small circles and ovals. The top-right quadrant has vertical lines and a bracket-like shape. The bottom-left quadrant contains a large '3' and smaller symbols. The bottom-right quadrant has a horizontal line and a vertical line with a cross.



$$y_0 - s_0 = \sum_{i=1}^m h_i \sum_{j=1}^{a_{ij}} a_{ij}$$

bank balance

$$800 \text{ cr} = \underline{\underline{500}}$$

$$1000 \text{ deb } \therefore (-1000)$$

$$1760 \text{ deb } \therefore (-1700)$$

47800

upacademy
Sharing!



$$\begin{array}{r} -100 \\ \times 70 \\ \hline -700 \end{array}$$

$$-15)$$

$$+ 15$$

$$\begin{array}{r} + 15 \\ - 15 \\ \hline 0 \end{array}$$

ilogi

$$\begin{array}{r} 5) \times (-15) \\ \hline -15 \end{array}$$

= + 75

150 glass

U

30< <40

7

١٢٥

✓

30

A simple white stick figure outline on a black background. The figure has a circular head, a single vertical line for a body, and a V-shaped base for legs.

30
7

A simple white stick figure is standing upright against a black background. The figure consists of a circular head, a single vertical line for a body, and two diagonal lines extending from the bottom to represent legs.

30
7

۶۷

A stylized letter 'Q' logo, consisting of a large circle with a vertical line extending downwards from its center.

3

7

$$\begin{array}{r}
 & 37 \\
 4) & \overline{150} \\
 -120 \\
 \hline
 & 30 \\
 & \underline{28} \\
 & \hline
 & 2
 \end{array}$$

$\frac{400}{2) 801}$
 $\frac{800}{\hline}$
 $\frac{1.}{\hline}$

1894 ≈

~~$\begin{array}{r}
 & 3 \\
 4) & \overline{150} \\
 -120 \\
 \hline
 & 30
 \end{array}$~~

mole concn

Division

$$\begin{array}{r}
 & 15 \\
 12) & \overline{1894(1)00} \\
 & \underline{1200} \\
 & \hline
 & 694 \\
 & \underline{600}
 \end{array}$$

$$4) \overline{)150}$$

- 12

30
28

2

$$4) \overline{)148}$$

12

28

6

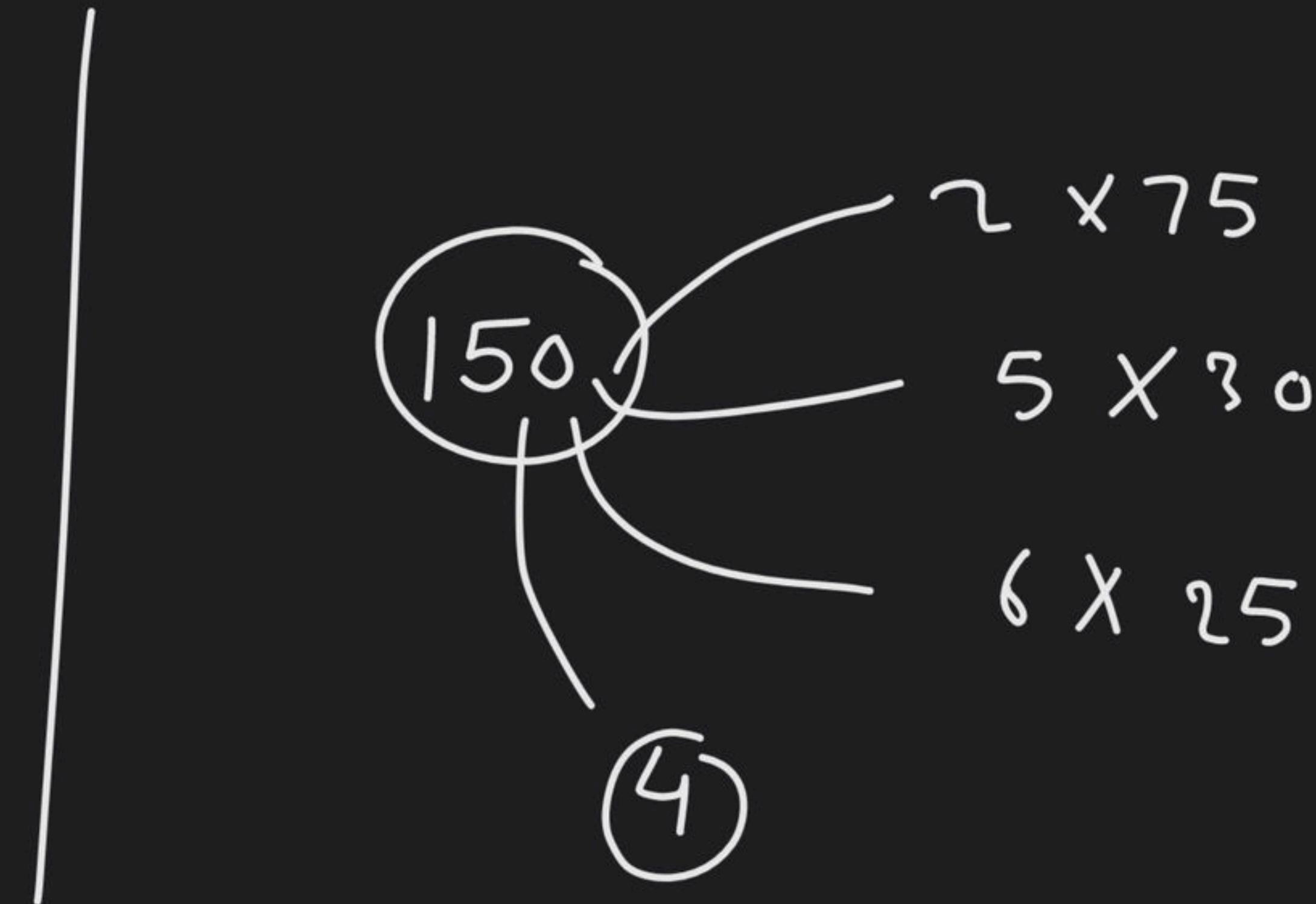
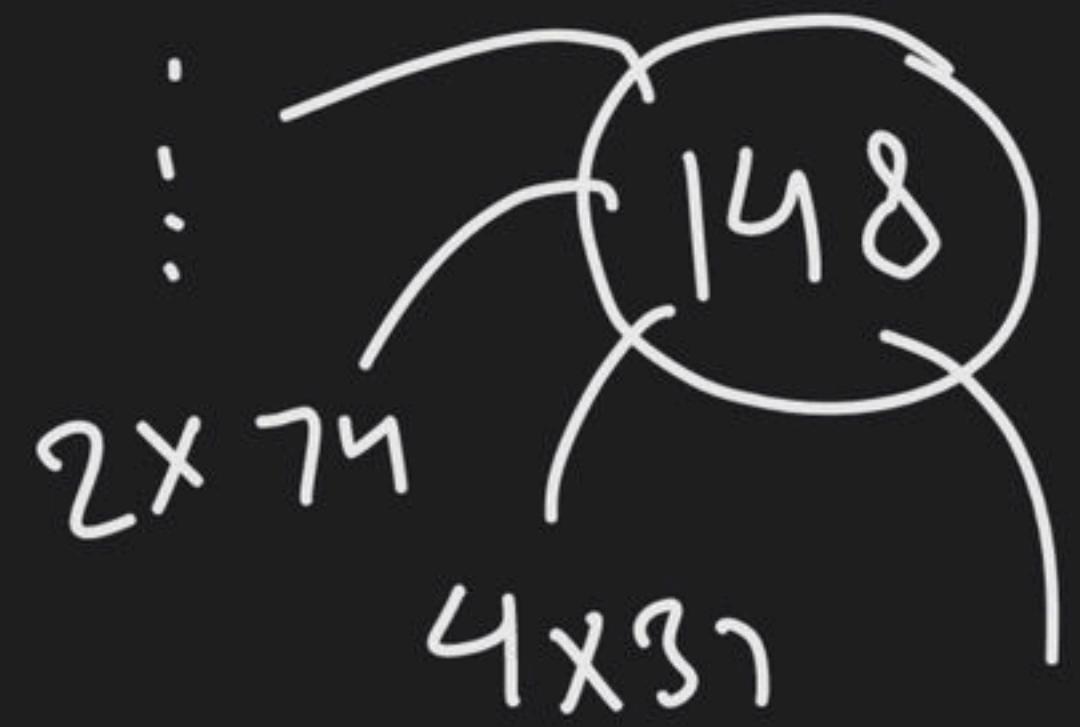
$$2) \overline{)150}$$

0

$$5) \overline{)150}$$

0

$$\begin{array}{r} 37 \\ \times 4 \\ \hline 148 \end{array}$$



$$I = \frac{2}{3} = 0.\overline{666666\dots}$$

Repr

Group-2

$\left[\frac{2}{3} = 0.\overline{666666\dots} \right]$

6.022×10^{23}

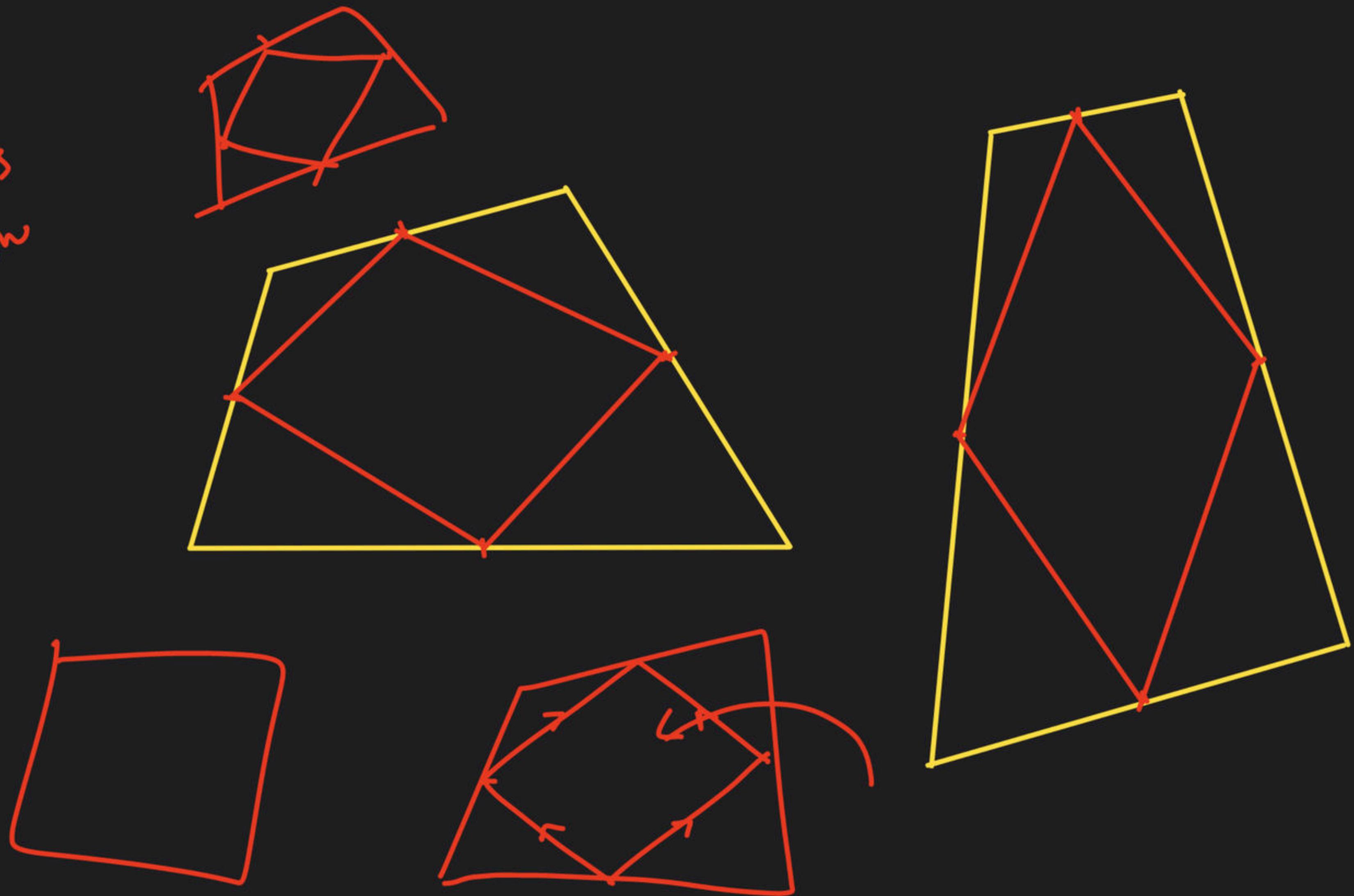
$6.623\dots$

$0.9999\dots = 1$

$0.61 \quad \checkmark$

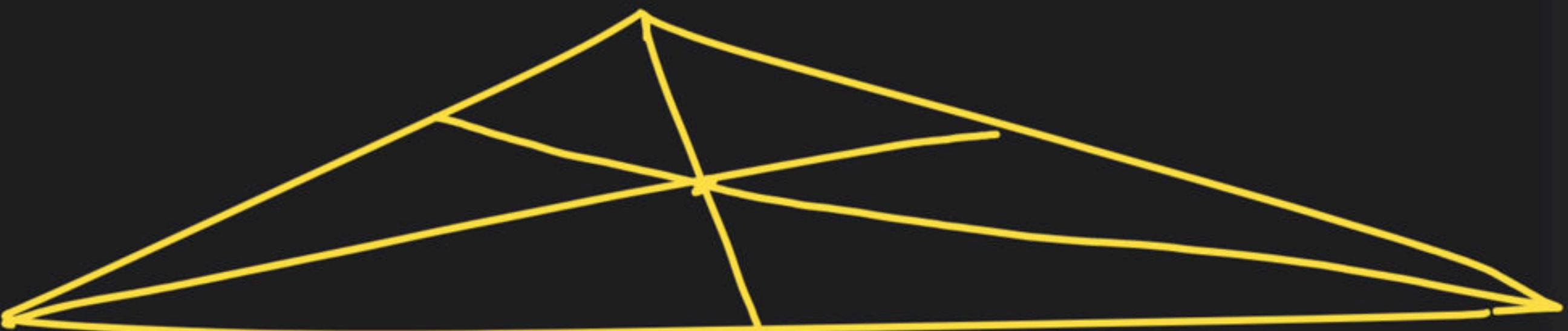
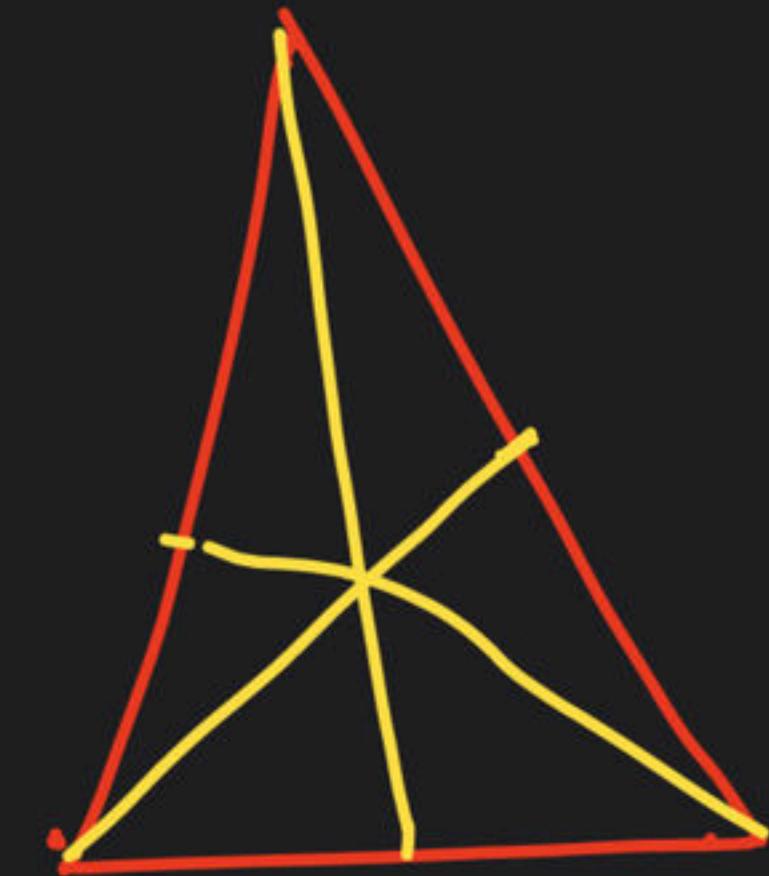
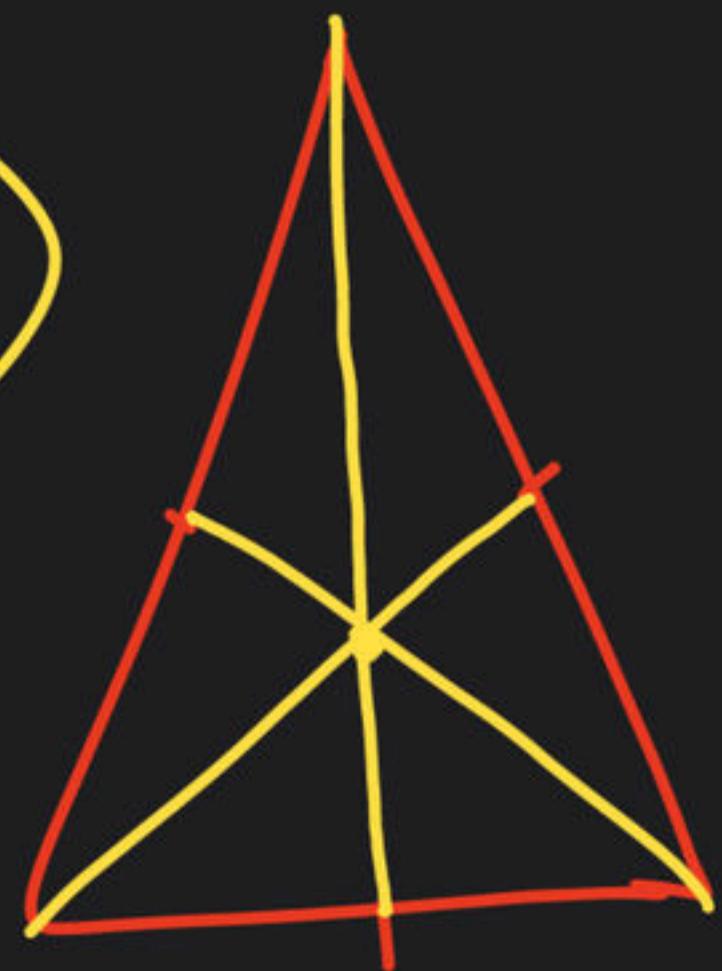
A large yellow bracket groups the fraction $\frac{2}{3}$ and its decimal representation $0.\overline{666666\dots}$. Another yellow bracket groups the number 6.022×10^{23} and the decimal $6.623\dots$. A third yellow bracket groups the decimal $0.9999\dots$ and the value 1 . A yellow circle with a checkmark is next to the decimal 0.61 .

Chaos
Team



M.R.

M.P.



Grapping of 10 was a cultural choice

$10^3, 10^2, 10^1, 10^0$



