Intro To Problem Solving With C++

Special class

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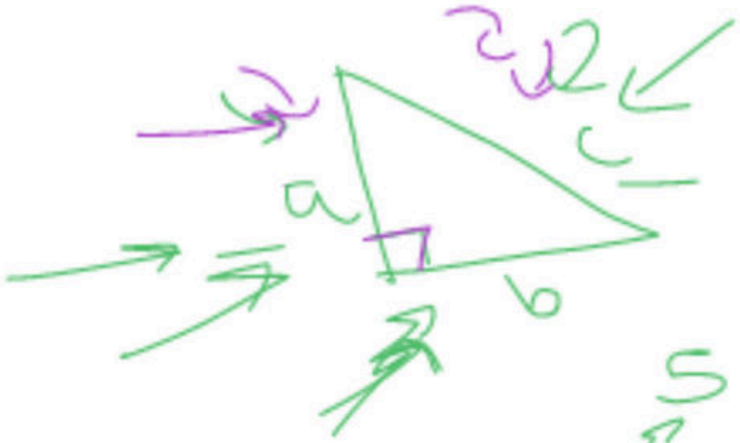
Q⇒ You have been given a number (X).

You need to find the primitive pythagorean triplet for x as one of the sides either base or height.

gcd(a,b,c) = 1



$a^2 + b^2 = c^2$ → pythagoras theorem

3,4,5

$5 \le x \le 10^9$

base or height

(a,b,c)

x = 5

5, 12, 13

⇒ Primitive pythagorean triplet

→ Lets say you have a right angled △, with sides x, y, z → coprime

if gcd(x, y, z) = 1

hcf

$a^2 + b^2 = c^2$

$b^2 = c^2 - a^2$

x^2

for a pythagorean triplet to be primitive, we know that they can be represented as

$(m^2 - n^2, 2mn, m^2 + n^2)$

[for any pythagorean triplet, atleast one side is even]

for 3 sides a, b, c → $a^2 + b^2 = c^2$ → pythagoras thm

Then at least one of them is even

a, b

→ if any 2 sides are even

→ if any 2 sides are odd

a → even, b → even

a → even, b → odd

$a^2 + b^2 = c^2$ → c odd

c odd

$a \rightarrow$ odd $\quad b =$ odd $\quad c \rightarrow$ even

$a \rightarrow (2N+1) \qquad b = (2K+1)$

$$c^2 = a^2 + b^2 = (2N+1)^2 + (2K+1)^2$$

$$= 4N^2 + 1 + 4N + 4K^2 + 4K + 1$$

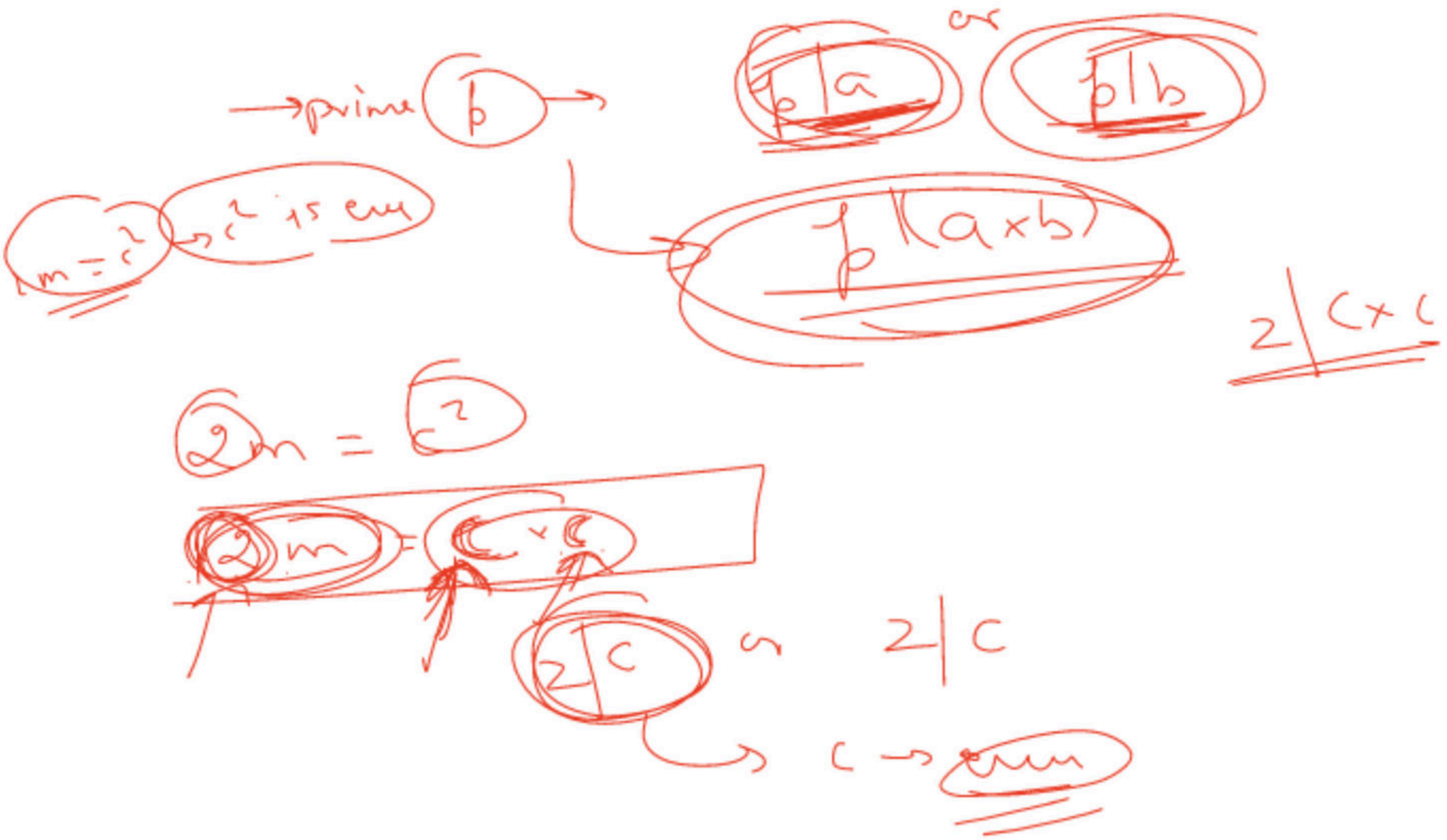
$$= 2(2N^2 + N + 1 + 2K^2 + 2K)$$

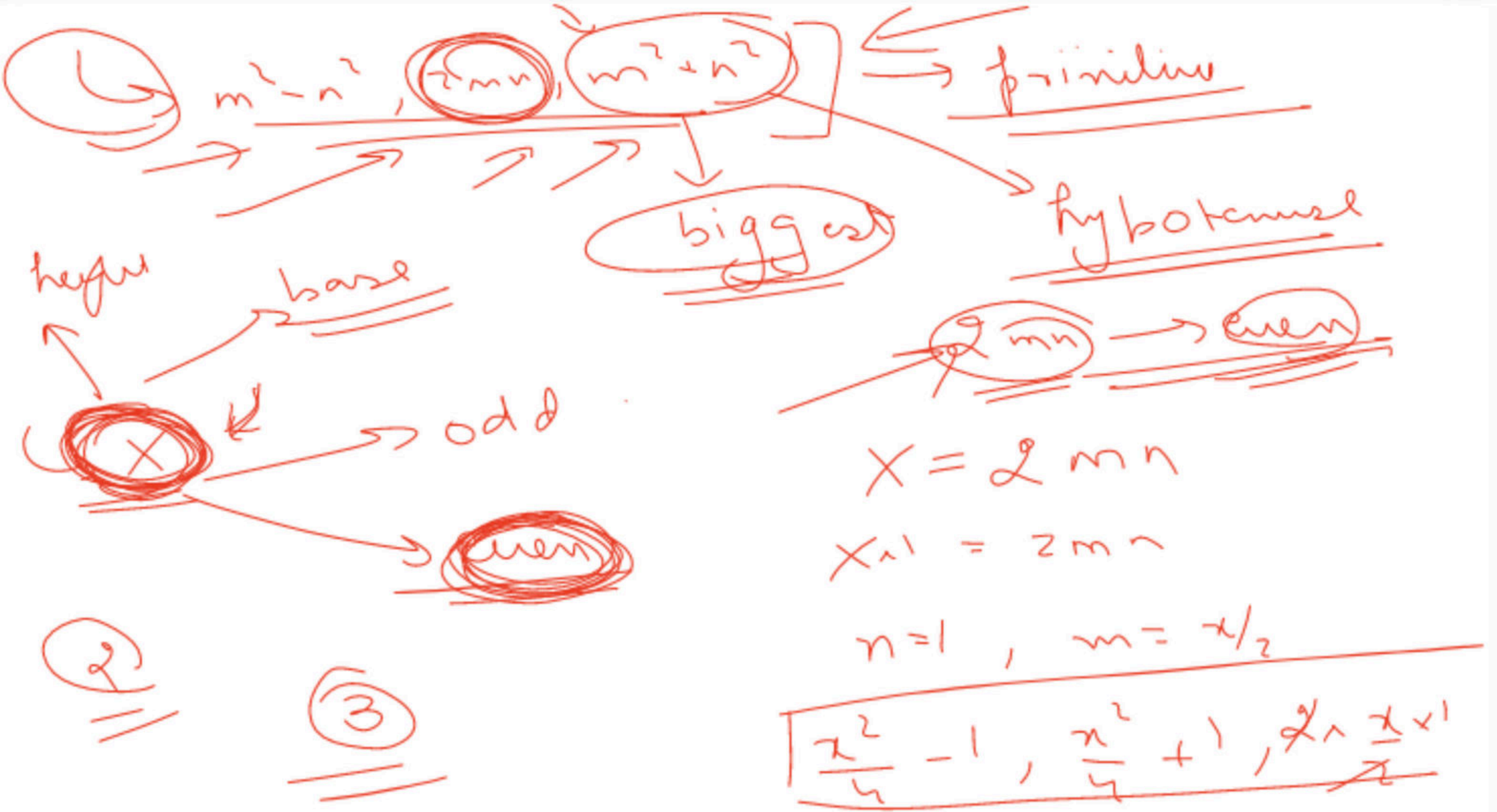
$$= 2M$$

prime ?

M

$$\boxed{2M = c^2}$$


prime
p
or
p | a
p | b
p | (a x b)
m = c²
c² is even
2 | c x c
2m = c²
2m
x c
2 | c
c is even


$m^2 - n^2$, $2mn$, $m^2 + n^2$
primitive
biggest
hypotenuse
height
base
odd
even
mn
even
$x = 2mn$
$x^1 = 2m^1$
$n = 1$, $m = x/2$
$\frac{x^2}{4} - 1$, $\frac{x^2}{4} + 1$, $2^{\frac{x}{2}+1}$
2
3

$x = 2mn$

$mn = \frac{x}{2}$

$m = \frac{\sqrt{x}}{\sqrt{2}}$ $\quad n = \frac{\sqrt{x}}{\sqrt{2}}$

$m = -\frac{\sqrt{x}}{\sqrt{2}}$ $\quad n = -\frac{\sqrt{x}}{\sqrt{2}}$

$m = \frac{x}{2}$ $\quad n = 1$

or

$m = 1$ $\quad n = \frac{x}{2}$

$$\frac{x^2}{4} - 1 \quad , \quad x \quad , \quad \frac{x^2}{4} + 1$$

$$2mn = x$$

$$mn = \frac{x}{2}$$

$$n = 1 \qquad m = \frac{x}{2}$$

$\rightarrow (m^2 - n^2, \underline{2mn}, m^2 + n^2)$ $\longrightarrow$ HW

one side

a, b, c $\longrightarrow$ one of them is even

$\downarrow$

$\otimes$

$\hookrightarrow$

$x = 2mn$

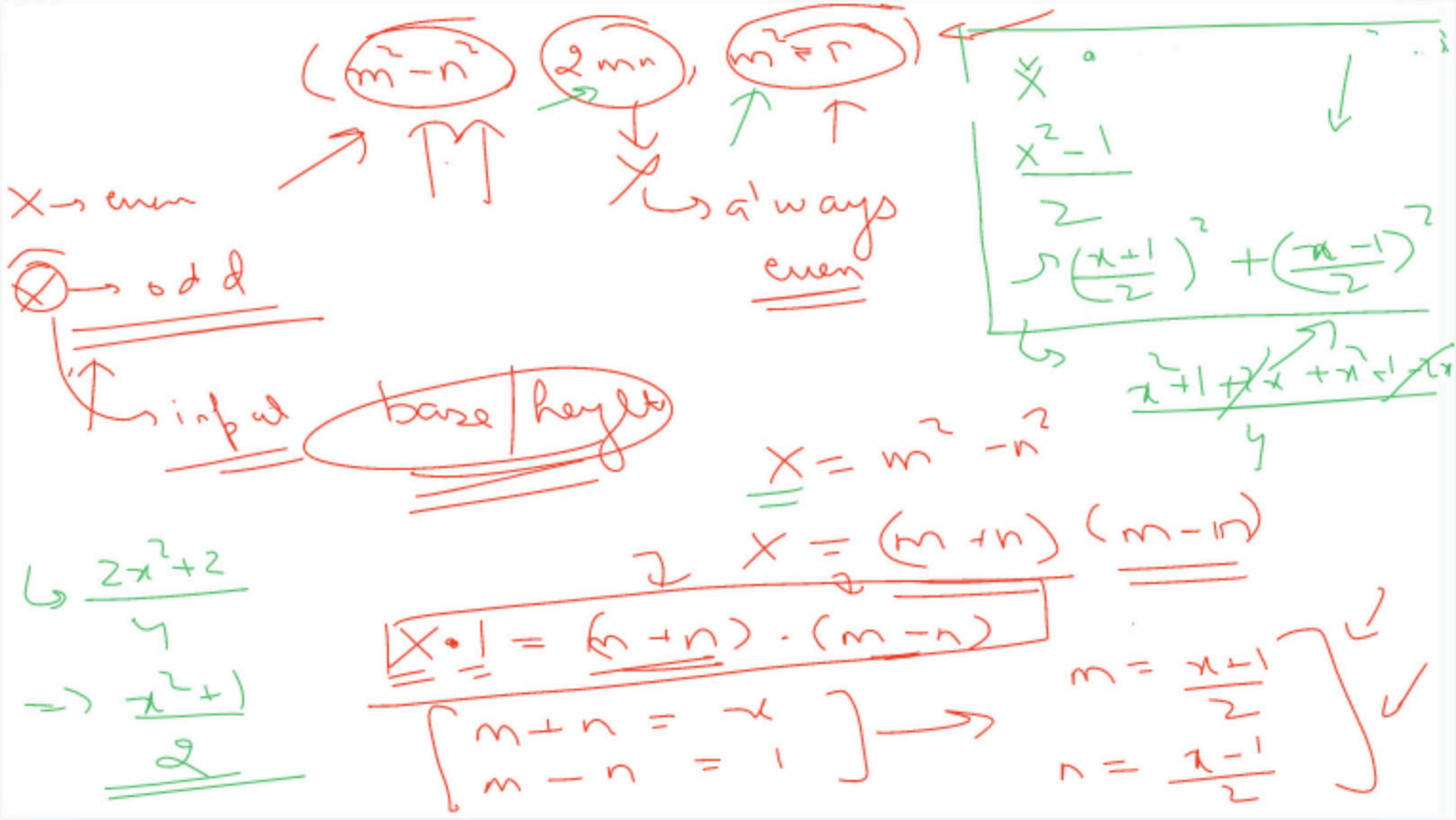
$mn = \frac{x}{2}$

Let $n = 1$ $\Rightarrow m = \frac{x}{2}$

$\hookrightarrow$

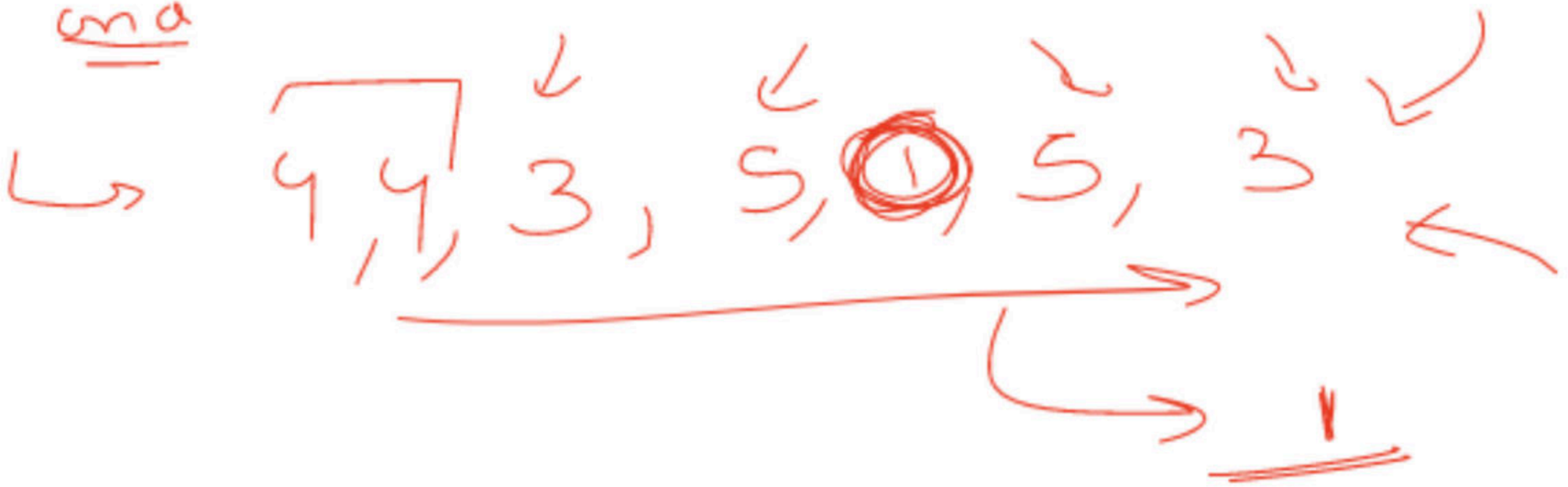
$\left(\frac{x^2}{4} - 1, x, \frac{x^2}{4} + 1\right)$

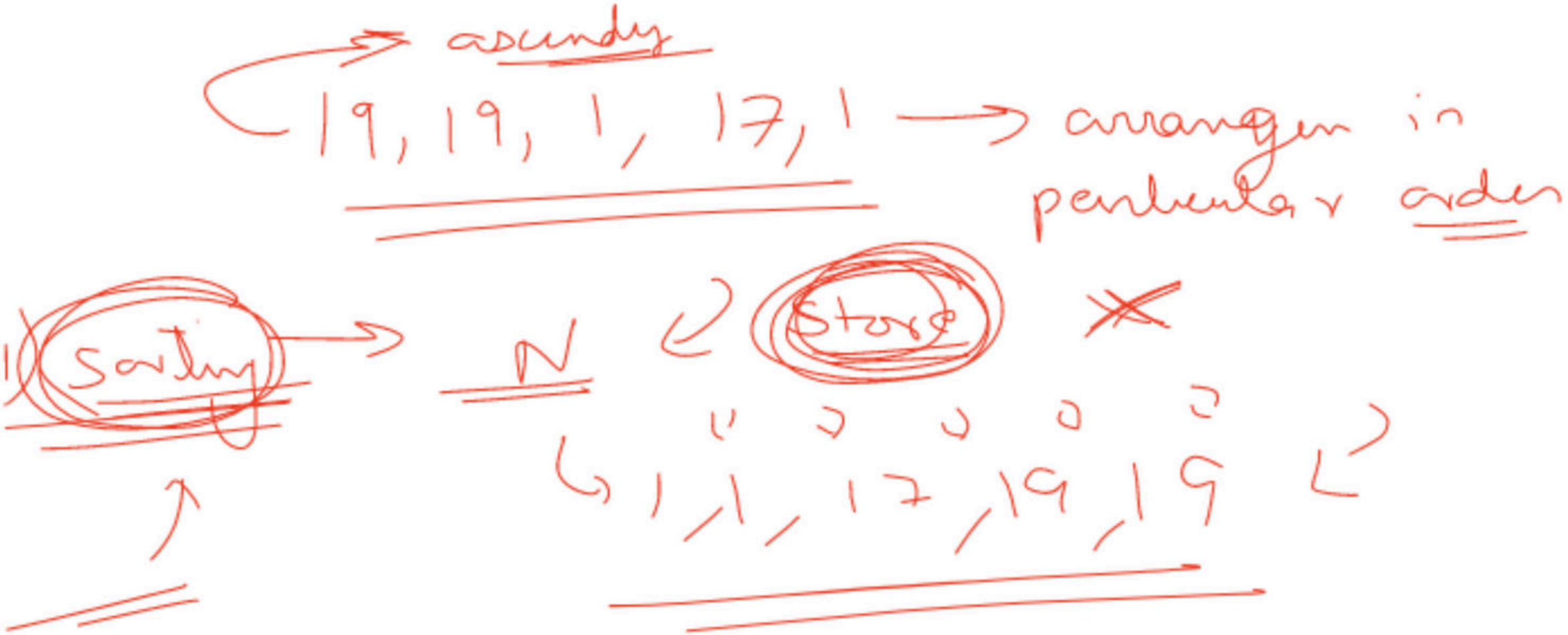
$a \quad b \quad c$


m^2-n^2
$2mn$
m^2+n^2
always
even
x even
odd
input
base | height
x
x^2-1
2
$\left(\frac{x+1}{2}\right)^2+\left(\frac{x-1}{2}\right)^2$
$x^2+1+x+x-1$
4
$\frac{2x^2+2}{4}$
$\frac{x^2+1}{2}$
$x = m^2-n^2$
$x = (m+n)(m-n)$
$x \cdot 1 = (m+n)\cdot(m-n)$
$m+n = x$
$m-n = 1$
$m = \frac{x+1}{2}$
$n = \frac{x-1}{2}$

Q: You will get N numbers, where every number occurs twice & one number occurs once. You have to find the number occurs once

ans




ascendy
19, 19, 1, 17, 1
arrangen in
perticular order
Sorting
N
Store
1, 1, 17, 19, 19

2 2 2 2 2 2 2

19, 19, 1, 17, 1

bits

1^1 = 0

0^0 = 0

X = 19

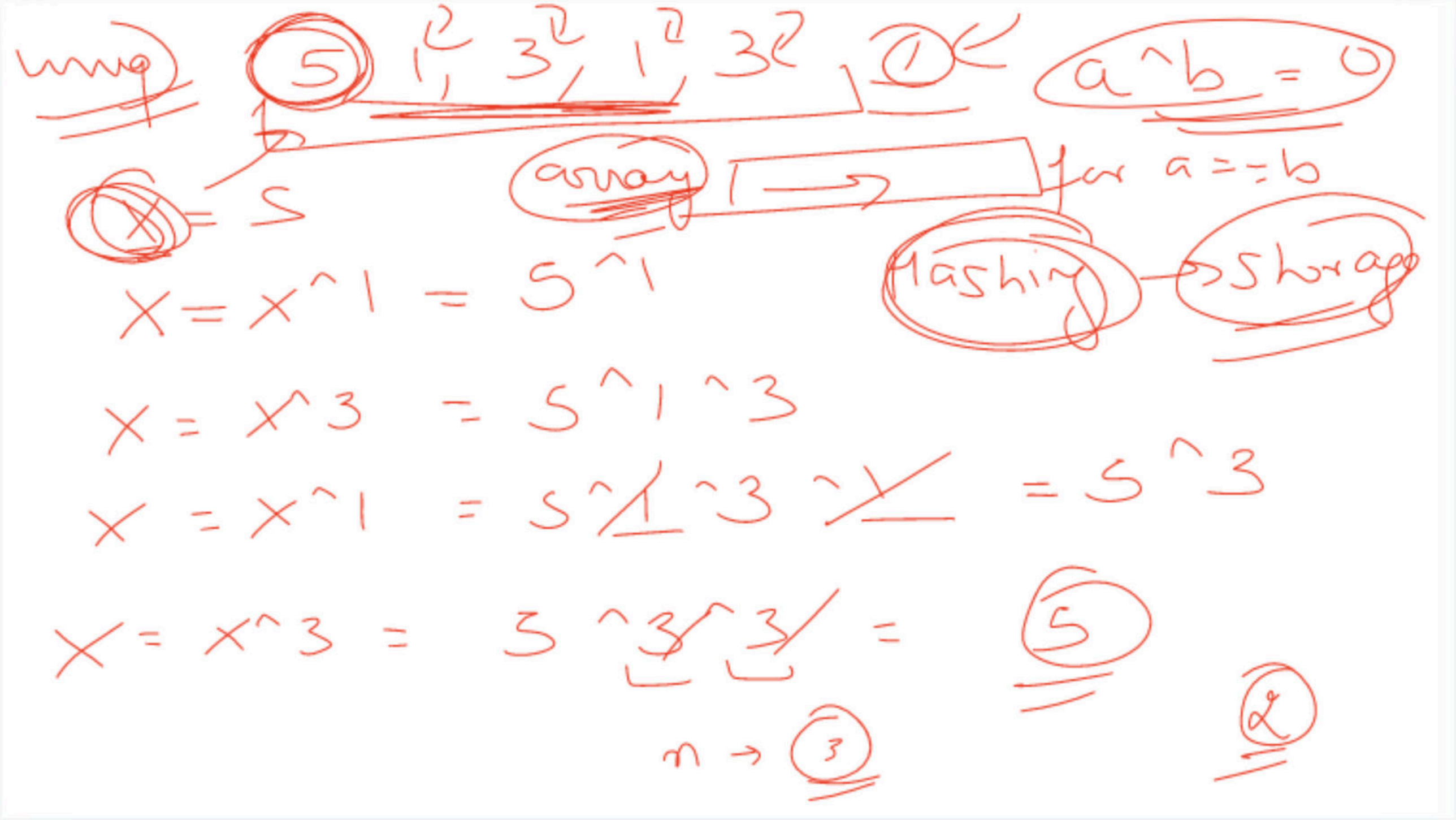
X = X ^ 19 => 0

X = X ^ 1 = 0 ^ 1 = 1

Unique

X = X ^ 17 = 1 ^ 17

X = X ^ 1 = 1 ^ 17 ^ X => 17


wrong
5
1 3 1 3
1
a^b = 0
= 5
array
for a =:= b
Hashing
Storage
X = X^1 = 5^1
X = X^3 = 5^1^3
X = X^1 = 5^1^3^1 = 5^3
X = X^3 = 5^3^3 = 5
n → 3
2

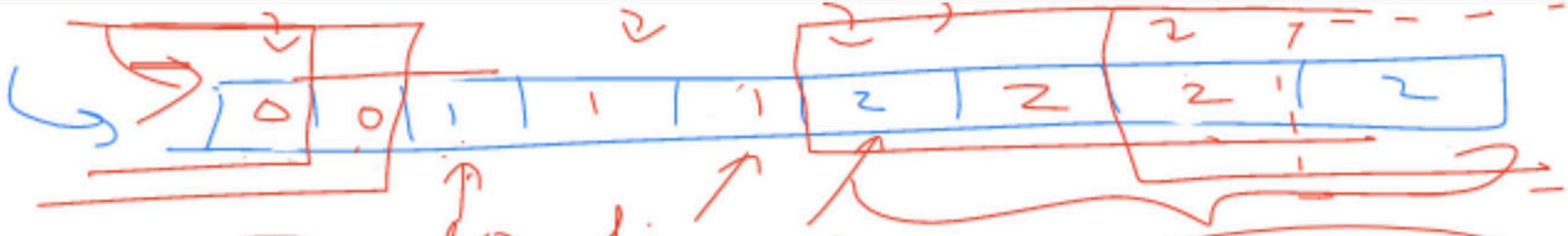
↳ 0, 0, 1, 1, 1, 2, 2, 2, 2 ← ans

array

1. st

will only have numbers as 0, 1, 2

→ In single pass, without extra space sort the array



sort

all twos

0, 1, 2

arr[mid] ?= 2

swap(arr[mid], arr[hi])

hi = hi - 1;

③ ⇒ DNF

arr[mid] == 1

mid = mid + 1

arr[mid] == 0

swap(arr[lo], arr[mid])

lo = lo + 1, mid = mid + 1

Freeclass

Youtube

Unacademy

SANKET 16

OC+

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