Sum of n natural nums

5 10

```
sum=0;
for (int i = 1; i <= n; i++)
{   i=1
    for (int j = 1; j <= i; j++)
    {
        sum++;
    }
}
```

i	j	Sum
1	1	1
2	1,2	3
3	1,2,3	6
4	1,2,3,4	10

$$1 + 2 + 3 + 4 + 5 \cdots n$$

$$\frac{n \times (n+1)}{2}$$

$$\frac{n^2}{2} + \frac{n}{2} =$$

$$\frac{n^2}{2} + \frac{n}{2}$$

5

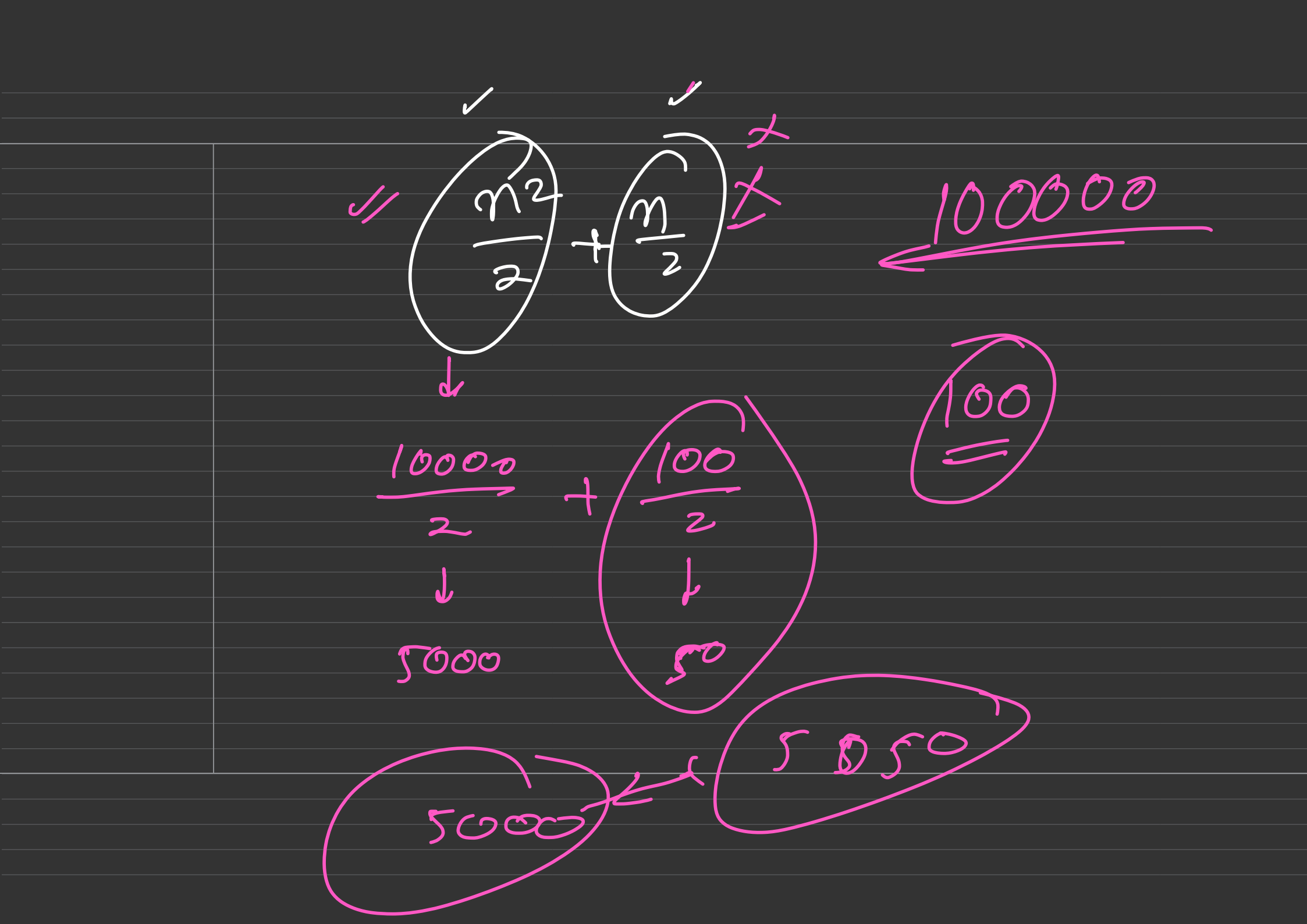
$$\frac{25}{2} + \frac{5}{2}$$

10

15 sec

$$\frac{100}{2} + \frac{10}{2}$$

55 sec


$\frac{n^2}{2} + \frac{n}{2}$
100000
100
$\frac{10000}{2}$
5000
$\frac{100}{2}$
50
5050
5000

$\frac{n^2}{2}$

100000

$n^2 - 10^8$

$\frac{n^2}{2} = 5 \times 10^7$

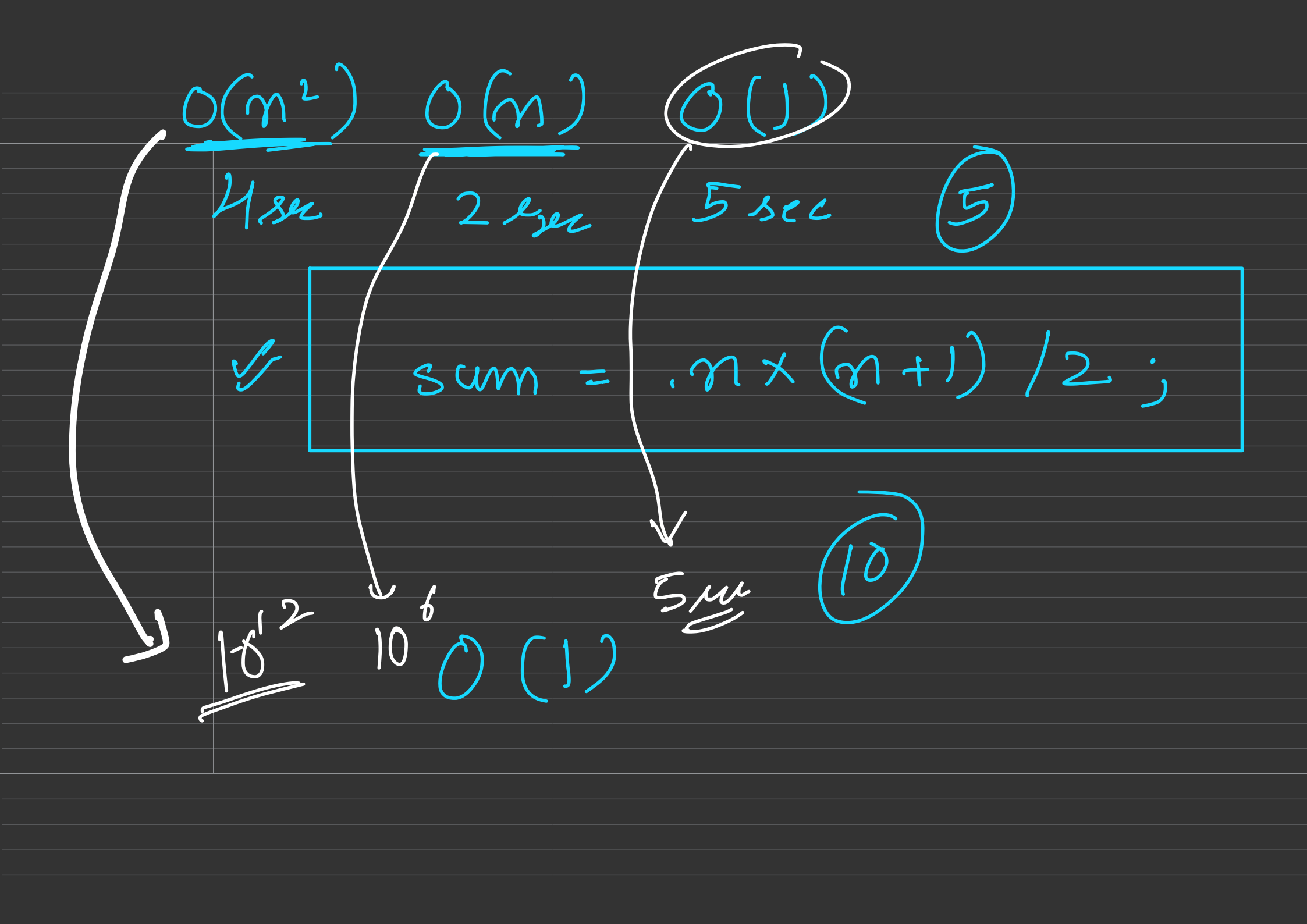
$\frac{n^2}{2}$

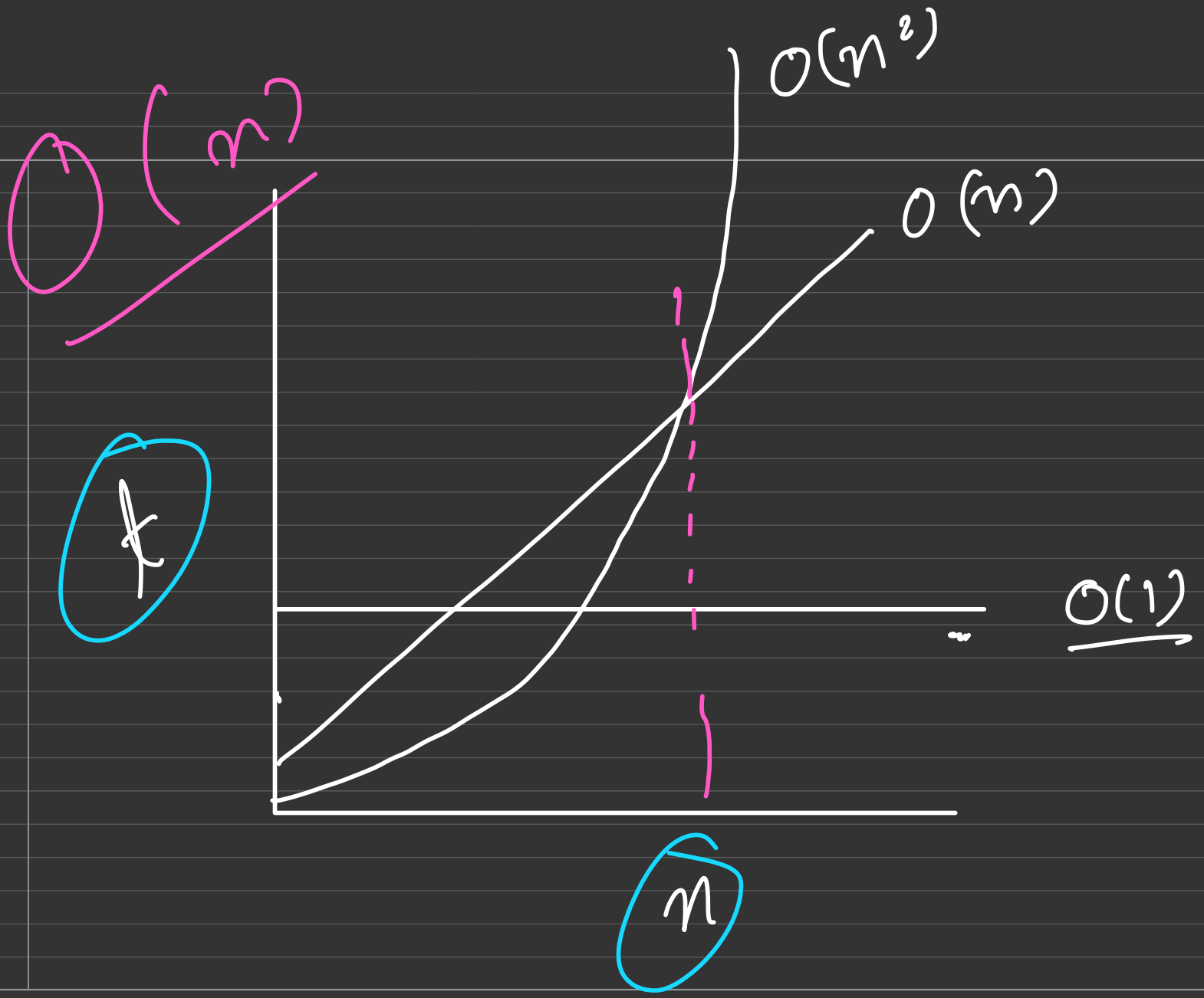
$\frac{10^9}{2}$? 5×10^8

```
Sum = 0;
for ( int i = 1 ; i <= n ; i++)
{
    sum += i ;
}
```

i	sum
1	1
2	3
3	6
4	10

O(n)

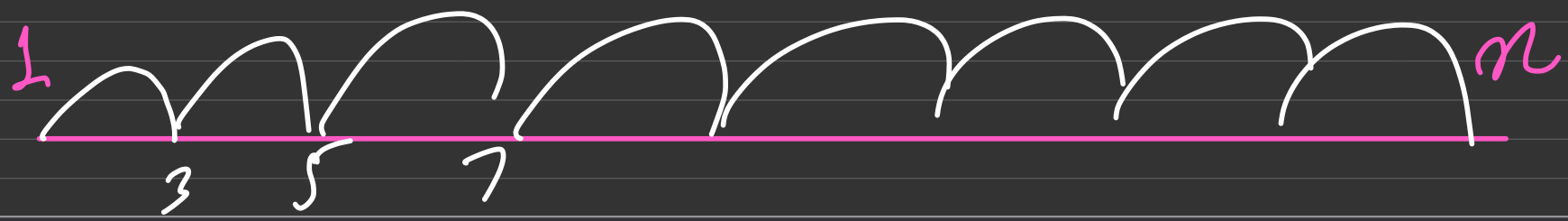

O(n²)
O(n)
O(1)
4 sec
2 sec
5 sec
5
sum = n × (n+1) / 2 ;
10
10^12
10^6
O(1)
5 sec


O(n²)
O(n)
O(n)
O(1)
t
n

```
for (int i = 1; i <= n; i += 2)
{
    printf("Faiz");
}
```

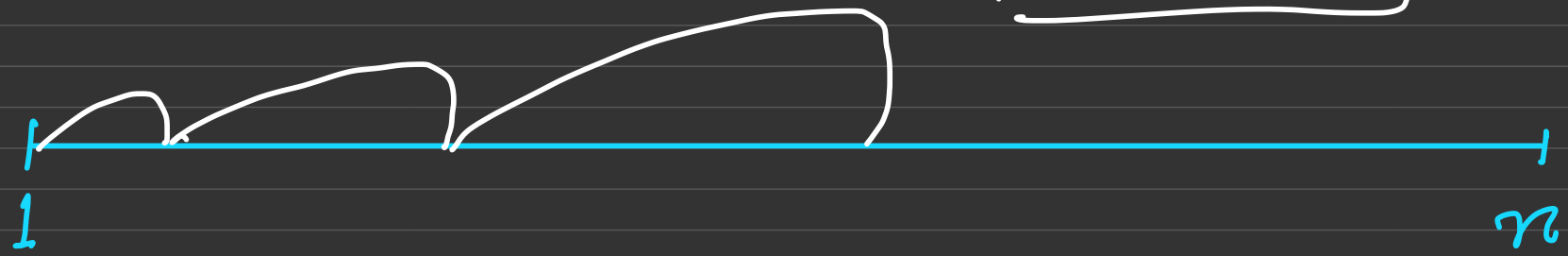
n/2

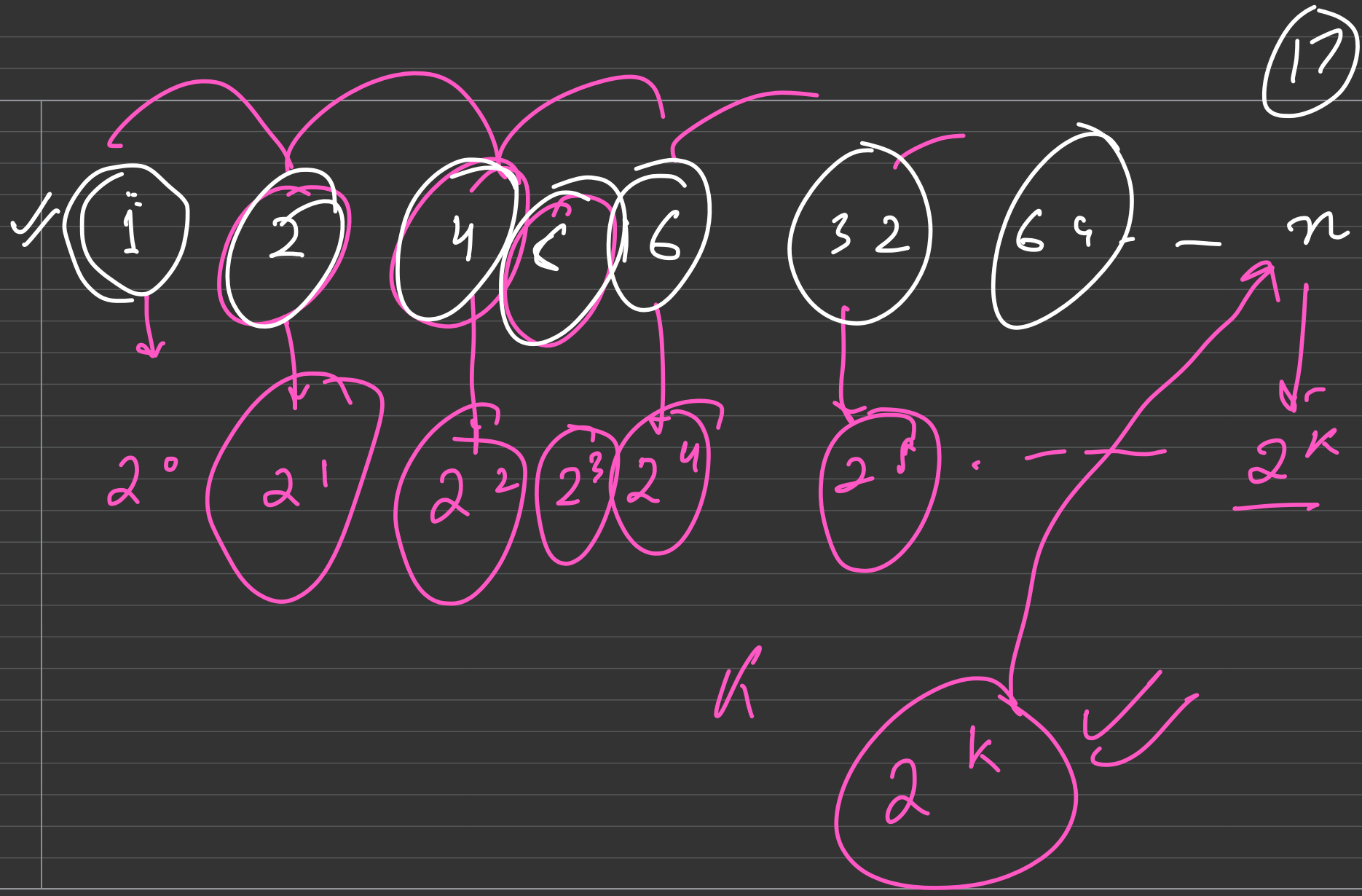
O(n)



```
for (int i = 1; i <= n; i *= k)
```

$\log_k n$




1
2
4
8
16
32
64
n
2^0
2^1
2^2
2^3
2^4
2^5
2^k
k
2^k

$$2^k = n$$

$$\log(2^k) = \log(n)$$

$$k \log 2 = \log(n)$$

$$k = \frac{\log(n)}{\log 2} = \log_2 n$$

$$\frac{\log n + 1}{\log n - 1}$$

$$(k-1)^k = \log n$$

$$k$$

for (int i = n ; i >= 1 ; i /= 2)

{

$$n \quad \frac{n}{2} \quad \frac{n}{4} \quad \frac{n}{8} \quad \ldots \quad 1$$

$$\frac{n}{2^0} \quad \frac{n}{2^1} \quad \frac{n}{2^2} \quad \frac{n}{2^3} \quad \ldots \quad \frac{n}{2^k}$$

}

$$\frac{n}{2^k} = 1$$

$$k = \frac{\log n}{\log 2}$$

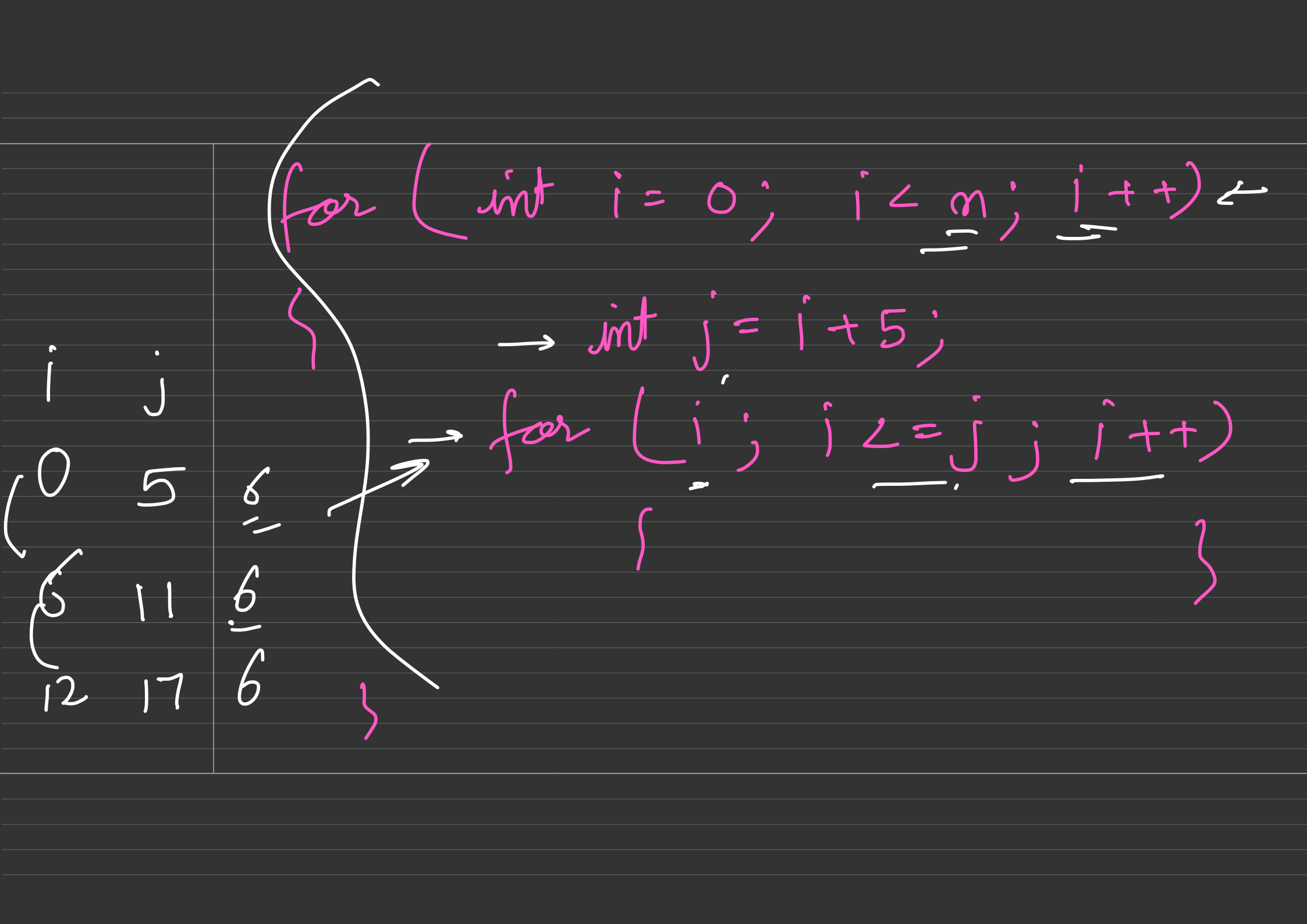
$$n = 2^k$$

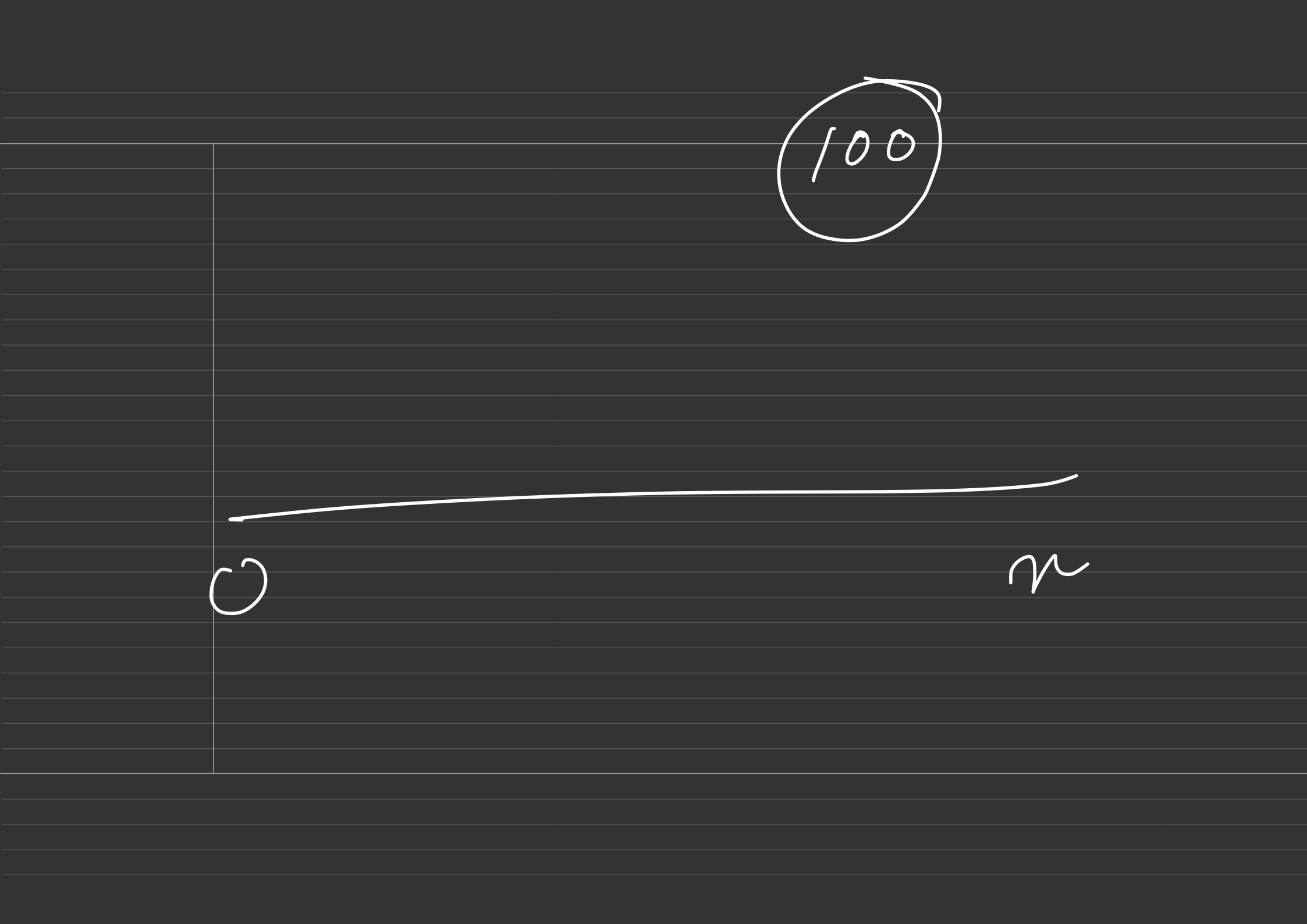
$$\underline{k = \log_2 n}$$

$$\log n = \log 2^k$$

$$\log n = k \log 2$$

```
for (int i = 0; i <= n; i = i*6)
{
    i = 0
      0
      0
      0
}
```


for (int i = 0 ; i <= n ; i++)
{
→ int j = i+5 ;
→ for (i ; i <= j ; i++)
{
}
}
i j
0 5 6
6 11 6
12 17 6


100
0
n

[1, 2, 6, 8, 3, 4, 12]

```
for (i = 1; i * i <= n; i++)
```

```
for ( int i = 1; i <= n; i++)
{
    for (int j = 1; j <= n; j = j*2)
    {
    }
}
```

$\log n$

$n \times \log n$