⊙ POWER FUNCTION

$$power(x, n) = x * x * x \ldots * x \ (n \ times) = x^n$$
$$power(x, n-1) = x * x * \ldots x \ (n-1 \ times) = x^{n-1}$$
$$power(x, n) = x^n = x^{n-1} * x \quad | \quad \text{Recursive Relation}$$

$$\therefore \quad power(x, n) = power(x, n-1) * x$$

$$\therefore \quad x^n = x \cdot x^{n-1} \qquad \qquad \therefore \quad x^n = x^{n/2} \cdot x^{n/2}$$

☆

$$x^n = \begin{bmatrix} x^{n/2} \cdot x^{n/2} \ ; \ n = Even \\ x^{n/2} \cdot x^{n/2} \cdot x \ ; \ n = Odd \end{bmatrix} \xleftarrow{Generally} \begin{cases} x^{18} = x^9 \cdot x^9 & Even \\ x^{17} = x^8 \cdot x^8 \cdot x & Odd \end{cases}$$

☆

☆

Expectation meet Faith

$P(x, 1024) = P(x, 512)$
$*$
$P(x, 512)$

if
$P(x, 1023) = P(x, 511)$
$*$
$P(x, 511)$
$*$
x

Expectation

$P(x, 1024) = x \ldots 1024 \ times$

Faith

$P(x, 512) = x \ldots 512 \ times$

```
ps vm (s[] a) {
Scanner s = new Scanner (System.in);
int x = s.nextInt ();
int n = s.nextInt ();
int xn = power (x, n);
Syso (xn);
}
P s  int power (int x, int n) {
   if (n == 0)
      return 1;  → x ki power n/2 ─→ ①
   int xpnb2 = power (x, n/2);  ⎤ even case
   int xn = xpnb2 * xpnb2;  ─→②⎦
   if (n % 2 == 1) {           ⎤ odd case ③
      xn = xn * x;             ⎦
   }
   return xn; →④
}
```

. After base case
condition is attained
one-by-one values
will be pop out of
stack.

N	$\rightarrow$ $\log_2 N$
10	$\rightarrow$ 3.321
100	$\rightarrow$ 6.642
10^3	$\rightarrow$ 9.9 $\approx$ 10
10^4	$\rightarrow$ 13.28
10^5	$\rightarrow$ 16.60

Space Complexity : $O(1)$

↓	10	0		
1 234	10	1	1	$1 \cdot 10 \rightarrow 10$
1 234	10	2	10	$\cdot 10^2$
1 234	10	4	10^2	10^4
1234	10	8	10^4	$10^8 \rightarrow$ Returned
↑	x	n	x^{pnb2}	x^n

k^{th} term

$$\underbrace{n, n/2, n/4, \cdots}_{K-terms} \quad ① : GP$$

$$\begin{bmatrix} x, \# \\ \vdots \\ x, n/4 \\ x, n/2 \\ x, n \end{bmatrix}$$

$\therefore a = n$

$r = 1/2$

GP n^{th} term : $a_k = a r^{k-1}$

$$1 = n\left(\frac{1}{2}\right)^{k-1}$$

$\therefore K =$ no. of levels

$$\therefore \frac{n}{2^{k-1}} = 1 \implies n = 2^{k-1}$$

Taking log both side

$\therefore$ ⊘

no. of levels α $\log_a n$

$$\boxed{\log_2 n = \log_2 2^{k-1}}$$

Suppose $(x, 32)$

$\therefore$ Jab base same ho
toh power atti hai

x^1	level 6

$\therefore$ no. of levels $= \log(n)+1$

$$\boxed{\log_2 n = K-1}$$

$x, 2$ level 5

But in terms of
proportionality
+1 not matter
$\therefore$ we say

$$\boxed{K \alpha \log_2 n}$$

$x, 4$ level 4
$x, 8$ level 3
$x, 16$ level 2
$x, 32$ level 1

no. of levels α $\log n$

$2^5 = 32$ $\therefore \log(32) \Rightarrow 5$