2) Mathematics :-

i) Trailing Zero's in a factorial :-

```
function trailingZero (n)
{
    let res = 0
    for (let i = 5; i <= n; i = i*5)
    {
        res = res + n/i
    }
    return n
}
```

Logic

Trailing Zero's caused by 5

i.e; 30!

1 . . . 5 . . . 10 . . . 15 . . . 20 . . . 25 . . . 30

5   5x1   5x3   5x4   5x5   5x6

∴ There are 7 trailing zero's in 30.

$i = 5;\ \frac{30}{5} \rightarrow \boxed{6}$

$\text{Zero's} = 0 + \frac{n}{5} + \frac{n}{25} + \frac{n}{125} + \dots$

$i = 25;\ 6 + \frac{30}{25} \rightarrow \boxed{7}$

ii) Palindrome Number :-

```
function palNumber (n)
{
    let res = 0,
        temp = n;
    while (temp != 0)
    {
        let lastDigit = temp % 10;
        res = (res * 10) + lastDigit;
        temp = ~~(temp / 10);
    }
    return temp;
}.
```

(n)   (rev)

1 2 5 → 5 2 1

To find last digit of n we write

lastDigit = n % 10 → 5

n = Math.floor (n / 10) → 12

rev = 0 * 10 + lastDigit
= 5

[n = n/10 → int
temp = temp * 10 + lastDigit]

iii) Prime numbers :-

Let number = 12;

1	2	3	4	5	6	7	8	9	10	11	12
T	T	T	T	T	T	T	T	T	T	T	T

Start with i = 2

∴ i * i => false : j = i*i ; j <= n ; j += i

1	2	3	4	5	6	7	8	9	10	11	12
T	T	T	F	T	F	T	F	T	F	T	F

i = 3

1	2	3	4	5	6	7	8	9	10	11	12
T	T	T	F	T	F	T	F	F	F	T	F

```
function listPrime (n){
    let array = new Array(n+1).fill(true);
    array [0] = array [1] = false;
    for (let i = 2 ; i*i <= n ; i++)
      {
        if (array[i])
         {
           for(let j=i*i; j<=n ; j+=i)
               array [j] = false;
         }
      }
    return array;
}.
```

iv) LCM & H.C.F :-

```
function HCF (a, b)
{
    if (b==0) return a;
    return HCF(b, a%b);
}
```

LCM = (a*b) / HCF

gcd (a,b) = gcd (b, a%b)

Initial step doesnot change values.

gcd(24,60) = gcd (24, 60%24)

gcd (24,12) = gcd(12, 24%12)

gcd(12,0) => a = 12.

v) Modulo arithmetic

$10^9 + 7 \rightarrow 1000000007$

```
function superPower (long long a, long long b, int mod) a^b
{
    long long res = 1;
    while (b>0)
    {
        if (b&1 == 1)      "b%2"
            res = (res * a) % mod;
        a = (a* a) % mod;
        b = b>>1           "b÷2"
    }
    return res;
}.
```

ODD $\rightarrow a^5 = a \cdot a^{b-1}$ $\therefore b = 5$

Even $\rightarrow a^4 = (a^2)^{\frac{b}{2}}$ $\therefore b = 4$

Let res = 1;

if (b%2 == 1)

res = res * a;

a = a*a;

b = b/2.

In first

res = a * res = a

a = a * a = a^2

b = 5/2 => 2.

In step two

(b%2 == 1) false

$a^2 = a^2 * a^2 = a^4$

b = 2/2 = 1

In step three

(b%2 == 1)

res = $a * a^4 \Rightarrow a^5$

$a^4 = a^4 * a^4 \Rightarrow a^8$

b = 0

we have formulas

$(a+b)\%n = (a\%n + b\%n)\%n$

$(a*b)\%n = (a\%n * b\%n)\%n$