Permutation : means arrangement in definite order taken all things at a time
or taken some — " —

(I) Number of permutations of 'n' distinct things at 'n' places $= n!$

place → $\boxed{1}$ $\boxed{2}$ $\boxed{3}$ - - - - - - $\boxed{n}$

$$n \times (n-1) \times (n-2) - - - - - - \times 1 = n!$$

(II) Number of permutations of 'r' things out of 'n' distinct things. at 'r' places

$$= {}^{n}P_{r} = P(n, r)$$

$${}^{n}P_{r} = \frac{n!}{(n-r)!}$$

Place → $\boxed{1}$ $\boxed{2}$ $\boxed{3}$ — - - - $\boxed{r}$

$$\underbrace{n \times (n-1) \times (n-2) \times (n-(r-1))}_{\text{Ans.}}$$

$$n(n-1)(n-2)\cdots(n-r+1)\,\frac{(n-r)!}{(n-r)!} = \frac{n!}{(n-r)!}$$

$$\frac{n!}{(n-r)!} = {}^{n}P_{r}$$

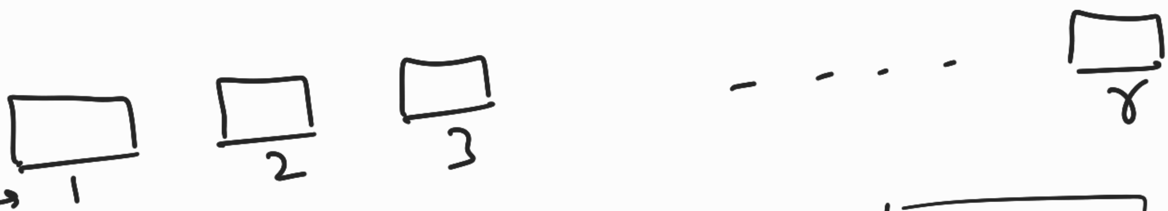
$n! = {}^{n}P_{n} = P(n, n)$

<u>Combination</u> : means selection

selection of 'r' things out of n diff^nt^ things $= {}^{n}C_{r} = \dfrac{n!}{r!\,(n-r)!}$

$${}^{n}C_{r}\; r! = \frac{n!}{(n-r)!} = {}^{n}P_{r}$$

#



Places →

$\boxed{r \le n}$

$n \rightarrow$ diff^nt^ things

$$({}^{n}C_{r})\; r! = {}^{n}P_{r}$$

Ex:- 10 chairs, 6 persons

$$\underbrace{{}^{10}C_6}_{\text{Select 6 out of 10 chairs}} \cdot 6!$$

$$\boxed{\underline{1}\ \ \underline{2}\ \ \underline{3}\ \ \underline{4}\ \ \underline{5}\ \ \underline{6}}$$

Ex:- 6 chairs, 10 persons

$$\underbrace{{}^{10}C_6}_{\text{Select 6 out of 10 persons}} \quad 6!$$

$${}^{10}C_6 = \frac{10!}{6!\,4!} = \frac{10 \times 9 \times 8 \times 7 \times \cancel{6!}}{\cancel{6!} \times 24} = 210$$

$${}^{n}C_0 = 1 = {}^{n}C_n$$

$${}^{n}C_r = {}^{n}C_{n-r}$$

Properties

① $${}^{n}C_0 = 1 = {}^{n}C_n$$

② $${}^{n}C_r = {}^{n}C_{n-r} = \frac{n!}{(n-r)!\,r!}$$

③ If ${}^{n}C_x = {}^{n}C_y$ then

Either $x = y$ OR $x + y = n$

$\Rightarrow {}^{n}C_{x} = {}^{n}C_{y} \Rightarrow x = y$

${}^{n}C_{n-x} = {}^{n}C_{y} \Rightarrow n - x = y \Rightarrow x + y = n$

(4) ${}^{n}C_{r} \cdot r! = {}^{n}P_{r}$

(5) ${}^{n}C_{r} = \frac{n}{r}\, {}^{n-1}C_{r-1}$

(6) $\underbrace{{}^{n}C_{r} + {}^{n}C_{r-1}}_{\text{consecutive}} = {}^{n+1}C_{r}$

same

Ex:- 'MIRACLE'

Use All letters find number of permutations

(1) if vowel occupy even places

(2) if ——", —— odd places

M I

R A

C E

L

(1) $\_\ \boxed{\_}\ \_\ \boxed{\_}\ \_\ \boxed{\_}\ \_$

1 2 3 4 5 6 7

$3!\,4! = 144$

M I

R A

C E

L

② $\boxed{1}$ $\underline{\ 2\ }$ $\boxed{3}$ $\underline{\ 4\ }$ $\boxed{5}$ $\underline{\ 6\ }$ $\boxed{7}$

$$^4C_3 \quad 3! \cdot 4! = 4 \times 6 \times 24 = 576$$

↑ select 3 position out of 4 odd positions

Ex :- In how many ways a cricket team of 11 players be formed out of 15 players

If Q① No condition $= {}^{15}C_{11}$

Q② If two particular players are always included $= {}^{13}C_{9}$

$\overset{15}{\boxed{A, B, 13}} \longrightarrow \overset{11}{\boxed{A, B, 9}}$

Q③ If two particular players never included ${}^{13}C_{11}$

$\underset{15}{\boxed{\cancel{A, B}, 13}}$ $\quad$ $\underset{11}{\boxed{11}}$

Ex:- How many selection of 6 persons out of 5 men, 6 women can be made if men are in majority.

$\boxed{5M \mid 6W}$

5M 1W + 4M 2W

$^5C_5 \cdot {}^6C_1 + {}^5C_4 \, {}^6C_2 = 81$ Ans

$6 + 75$

Ex:- A person gives a party to his 6 friends out of 10 friends. In How many ways selections can be made if

Q ① Two particular friends comes together

$$\boxed{A, B, 8} \rightarrow \boxed{A, B, 4} \Rightarrow {}^8C_4$$

$+$

$$\boxed{A, B, 8} \rightarrow \boxed{\cancel{AB}, 6} \quad {}^8C_6$$

Q ② Two particular friends never come together

$= {}^{10}C_6 - {}^{8}C_4$

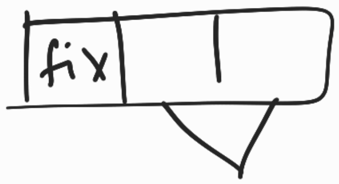
= Total − Both are together

\# ${}^{8}C_5 + {}^{8}C_5 + {}^{8}C_6$ $\quad \boxed{A, B, 8} = 10$

A, B, 5 x	A B, 5 x	A B 6 x x

Ex:- A father with 7 children, takes them three at a time to see a zoo without taking same three children together. Q① How many times father goes to zoo $= {}^{7}C_3$

Q② How many times each child goes to zoo $= {}^{6}C_2$



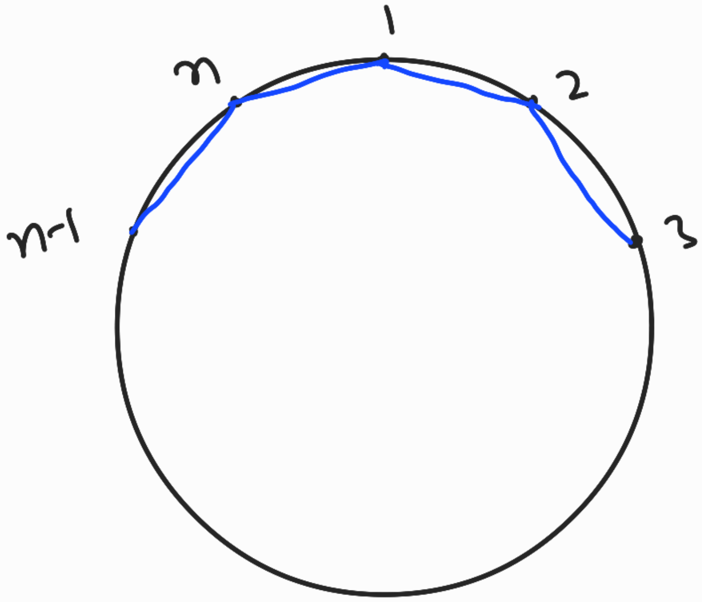
2 out of 6

Ex:- There are 'n' points in a plane no 3 of which are collinear find

(a) number of Straight lines $= {}^nC_2 \cdot 1$

(b) number of triangles $= {}^nC_3 \cdot 1$

Ex:-



n points on a circle

find number of diagonals

$$= {}^nC_2 - n$$

TOTAL no. of lines

n Sides of polygon

Ex:- 10 points in a plane, Exactly 4 points are collinear out of 10 point

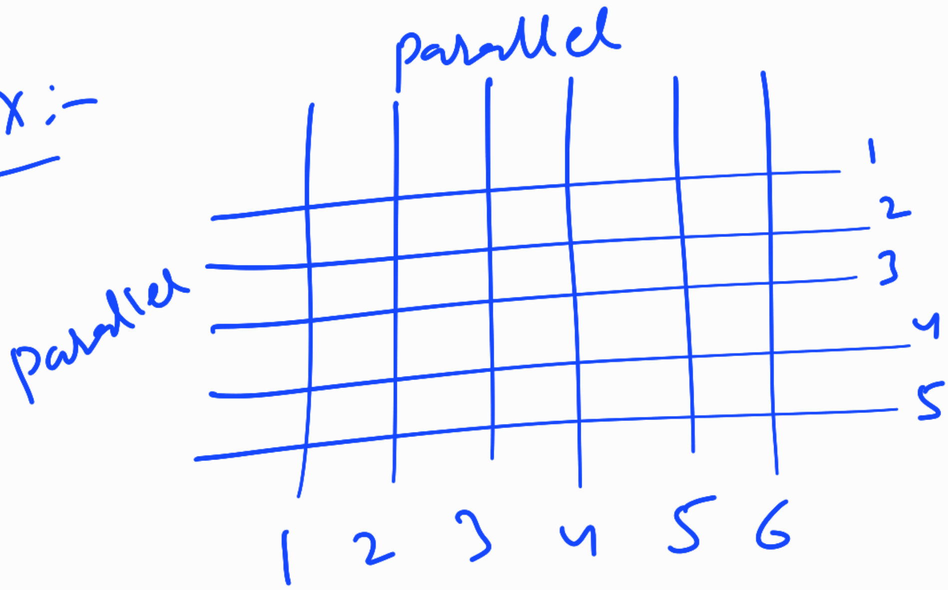
Find ① number of Straight lines

$$^{10}C_2 - {}^{4}C_2 + 1$$

10 points
no 3 points are
collinear

lines using
4 collinear
points

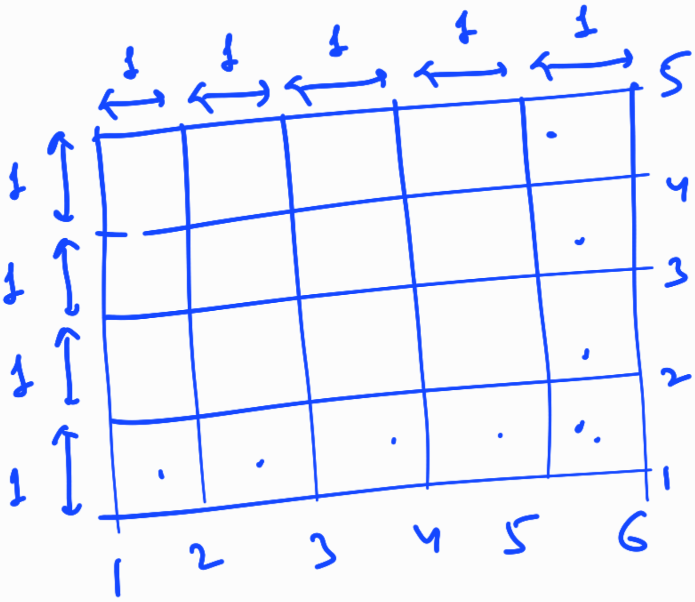
Ex:-



$\underbrace{6V, 5H}_{\text{lines}}$

find number of parallelograms $= {}^{6}C_2 \cdot {}^{5}C_2$

Ex:-



6V, 5H

V & H lines

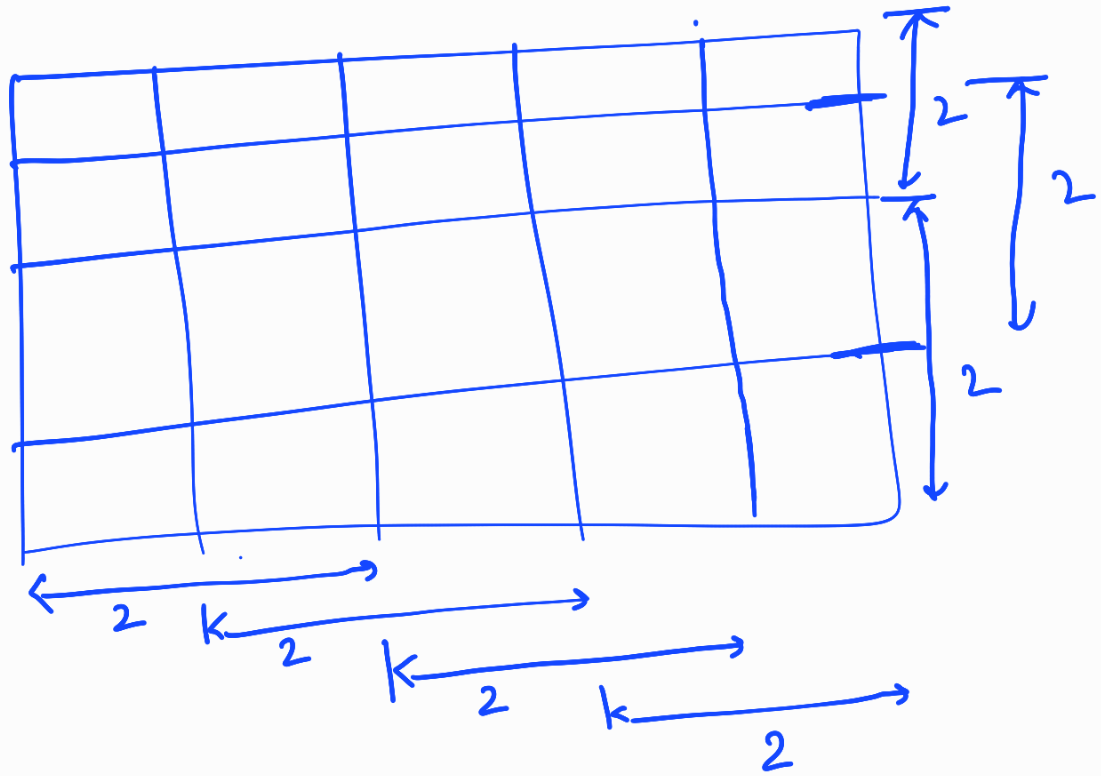
are far

Q① number of rectangles $= {}^{6}C_2 \cdot {}^{5}C_2$

Q (2) number of squares =

side × side	numbers
1 × 1	5 × 4 = 20
2 × 2	4 × 3 = 12
3 × 3	3 × 2 = 6
4 × 4	2 × 1 = 2
5 × 5	1 × 0 = 0

squares = 40



Ex:- In how many ways can the seven

different colours of rainbow be arranged so that blue & green are never come together

M#1 Total − Both are together

$7! - 6!\,2!$

$\boxed{BG}$ VIYOR

$\boxed{\text{VIBGYOR}}$

$\boxed{\text{M\#2}}$ Gap method

/ V / I / Y / O / R /

$5!$ $^6C_2$ $2!$

VIYOR — 2 gaps out of 6 gaps — B, G

Ex –

$\{1, 2, 3, 4, \ldots\ 19, 20\}$

number of ways in which three numbers are selected if they are in A.P.

Solⁿ $a, b, c \longrightarrow A.P.$

$\underbrace{2b}_{\text{even}} = a+c \Rightarrow a+c$ must be even

$a+c = \text{even}$

e e

OR o o

$a, c \rightarrow$ both even OR both odd

$^{10}C_2 + {}^{10}C_2 = 90$

M#2

$d=1$ (1,2,3) (2,3,4) (3,4,5) . . . (18,19,20) $\rightarrow$ 18

$d=2$ (1,3,5) (2,4,6) (16,18,20) $\rightarrow$ 16

$d=3$ (1,4,7) (14,17,20) $\rightarrow$ 14

12

$d=4$ ⋮

4

$d=9$ (1,10,19) (2,11,20) 2

Total $= 2+4+6+ \ldots +16+18 = 90$

Ex:- 8 Straight lines, 6 circles in a plane. find maximum number of point of intersection.

Sol^n $\Rightarrow$ $^8C_2 \times 1$ + $^6C_2 \times 2$ + $^8C_1\, ^6C_1 \times 2$

S.L & S.L.

circle & circle

SL & circle

H.W. $\Rightarrow$ S-1 11 to 13 | 01 Q1 to Q9