COUNTING + PERMUTATIONS

- "OUTCOMES" ARE THE RESULTS OF A PARTICULAR EVENT. THESE ARE SOMETIMES "CHOICES"

WE CAN USE
- SYSTEMATIC LISTING
- TWO-WAY TABLE
- TREE DIAGRAM.

"SAMPLE SPACE" IS A LIST OF <u>ALL</u> POSSIBLE OUTCOMES

eg. WHAT IS THE SAMPLE SPACE OF FLIPPING A COIN AND ROLLING A DIE?

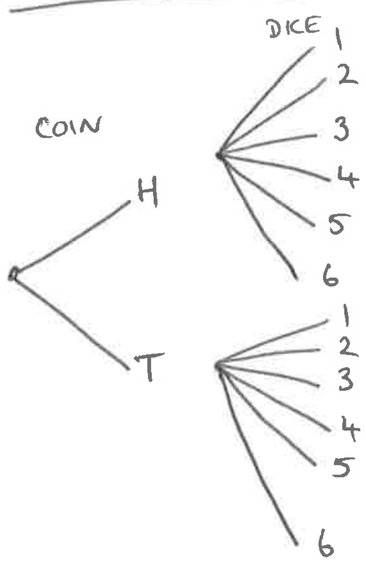
<u>SYSTEMATIC LISTING</u>

H1
H2
H3
H4
H5
H6
T1
T2
T3
T4
T5
T6

<u>TWO-WAY TABLE</u>

	1	2	3	4	5	6
H	H1	H2	H3	H4	H5	H6
T	T1	T2	T3	T4	T5	T6

<u>TREE DIAGRAM.</u>



FUNDAMENTAL PRINCIPLE OF COUNTING

IF ONE EVENT HAS m POSSIBLE OUTCOMES AND A SECOND EVENT HAS n POSSIBLE OUTCOMES, THEN THE TOTAL NUMBER OF POSSIBLE OUTCOMES IS $m \times n$

YOU CAN BE ASKED TO STATE THIS. YOU EITHER HAVE TO LEARN IT OFF OR BE ABLE TO EXPLAIN IT IN YOUR OWN WAY / WORDS.

ie. TO CALCULATE THE NUMBER OF OUTCOMES OF 2 OR MORE EVENTS, WE MULTIPLY THE NUMBER OF OUTCOMES OF EACH EVENT TOGETHER...

eg IN A RESTAURANT, THERE ARE 3 STARTERS
4 MAINS
2 DESSERTS.

THE NUMBER OF DIFFERENT MEALS THAT CAN BE ORDERED IS.

$$\underset{\text{STARTERS}}{\boxed{3}} \times \underset{\text{MAINS}}{\boxed{4}} \times \underset{\text{DESSERTS}}{\boxed{2}} = 24.$$

ARRANGEMENTS / PERMUTATIONS

eg ① HOW MANY WAYS CAN THE LETTERS OF THE WORD "MATHS" BE ARRANGED?

ANSWER :

THERE ARE 5 LETTERS

1ST LETTER	2ND	3RD	4TH	5TH
5	4	3	2	1

$\boxed{5} \times \boxed{4} \times \boxed{3} \times \boxed{2} \times \boxed{1}$

$= 5! = 120$

FACTORIAL

$5! = 5 \times 4 \times 3 \times 2 \times 1$

THIS CAN BE A QUICK WAY TO CALCULATE ARRANGEMENTS

USE THE "BOX METHOD"

i) HOW MANY WAYS CAN THE FIRST BOX BE FILLED?

2) HOW MANY WAYS CAN THE SECOND, THIRD, etc BOX BE FILLED?

3) MULTIPLY

② HOW MANY WAYS CAN THE SAME LETTERS BE ARRANGED IF ~~THE~~ THE ARRANGEMENTS MUST BEGIN WITH "H"

YOU MUST FILL IN ANY RESTRICTIONS FIRST

H

1ST

$\boxed{1}\ \boxed{}\ \boxed{}\ \boxed{}\ \boxed{}$

PUT THIS IN FIRST... THERE IS ONLY ONE WAY THAT THE 1ST BOX CAN BE FILLED...

THEN, ONCE THE H IS TAKEN, THERE ARE ONLY 4 LETTERS LEFT TO CHOOSE FROM, SO... (AND SO ON...)

H

1ST, 2ND

$\boxed{1} \times \boxed{4} \times \boxed{3} \times \boxed{2} \times \boxed{1} = 24.$

PERMUTATIONS – THIS IS THE SAME AS ARRANGEMENTS, EXCEPT WE DON'T HAVE TO USE <u>ALL</u> THE LETTERS / THINGS BEING ARRANGED.

eg SIX GREYHOUNDS (A, B, C, D, E, F) ENTER A RACE. HOW MANY DIFFERENT WAYS CAN THE FIRST 3 PLACES BE FILLED?

$$\underset{1^{st}}{\boxed{6}} \times \underset{2^{nd}}{\boxed{5}} \times \underset{3^{rd}}{\boxed{4}} = 120$$

NOTE:
THERE IS A WAY TO DO THIS ON YOUR CALCULATOR,

IT IS CALLED nPr

NUMBER

NUMBER OF PLACES / ITEMS TO BE SELECTED

PERMUTE

THE EXAMPLE ABOVE WOULD BE $6P3 = 120$.

YOU DON'T HAVE TO USE THIS METHOD TO SOLVE THIS TYPE OF PROBLEM