GRADE 12
COUNTING PRINCIPLES AND PROBABILITY PART 2

TERMINOLOGY RECAP

o Probability lies between 0 (impossible event) and 1 (certain event)

o If P(Event) = 1 means that it will definitely occur

o If P(Event) = 0 means that it is an impossible event

o If all events are equally likely, then the probability of the event is: $P(Event) = \dfrac{P(Successful\ Event)}{Total\ number\ of\ events}$
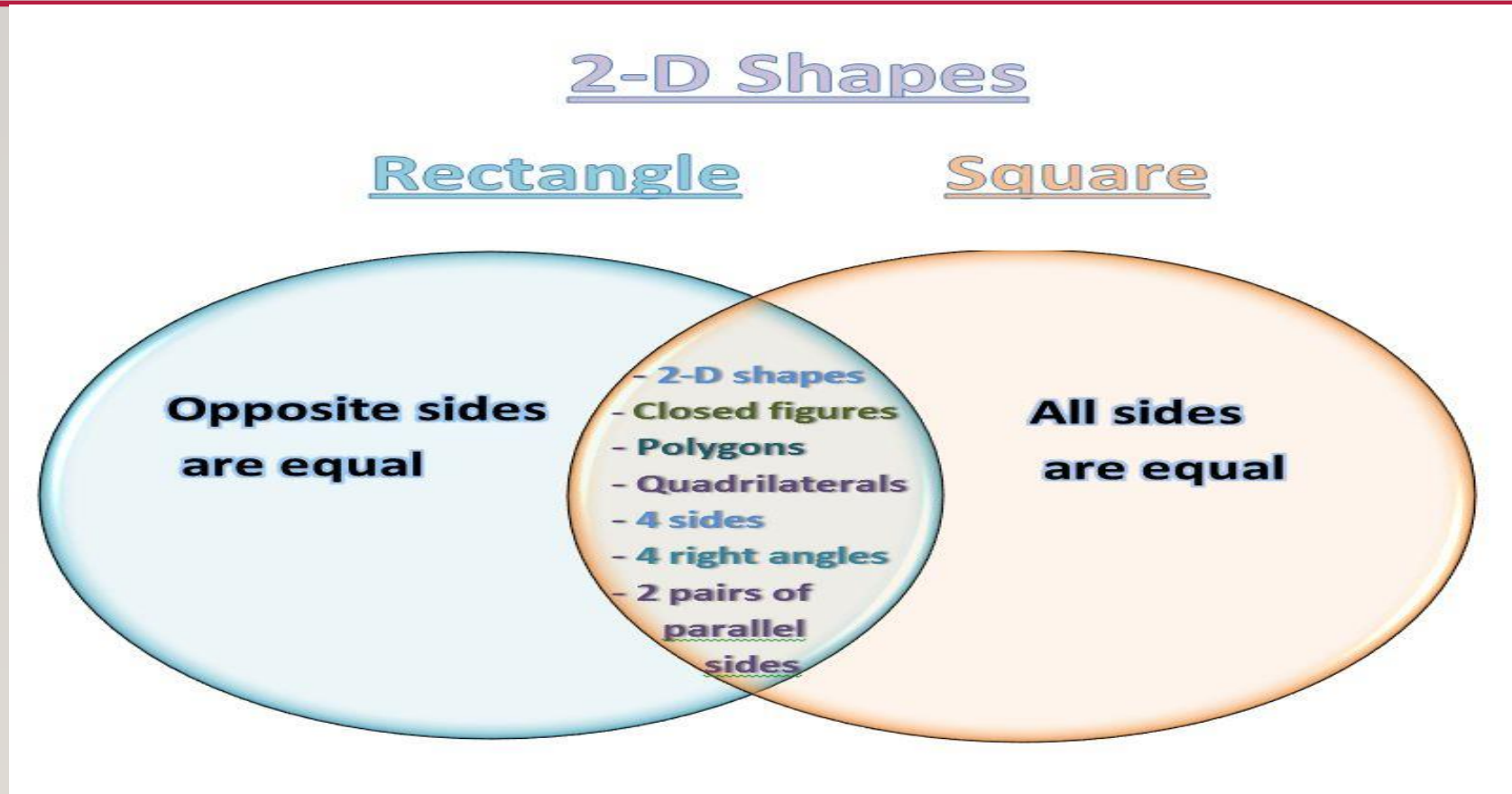
o Sample space is made up of all the possible events

TERMINOLOGY RECAP

o Set notation is often used, where

∪ is the union of sets

-> operation is OR

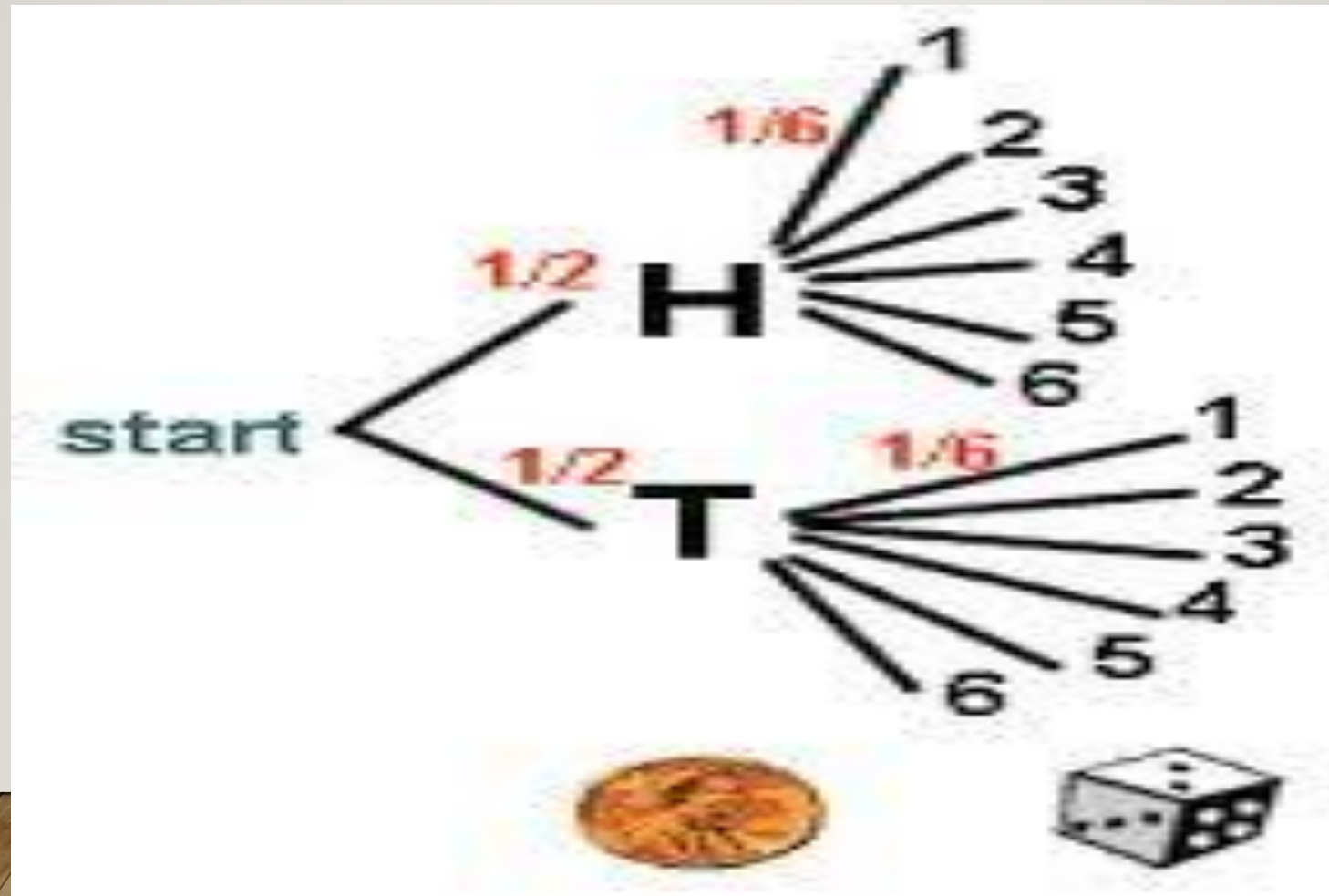∩ is the intersection of sets

-> operation is AND

Venn Diagrams

Show all possible logical relations between a finite collection of sets

TOOLS USED IN PROBABILITY

Tree Diagrams
   Have branches which show the possible outcomes of multiple types of events

TOOLS USED IN PROBABILITY

Contingency Table

Is a two-way table consisting of 2 variables to summarize data and compare the variables.

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

FUNDAMENTAL COUNTING PRINCIPLE

- If successive choices are made from $m_1, m_2, m_3, \ldots m_n$; then the number of combined options is the product thereof:

$$m_1 \times m_2 \times m_3 \times \cdots \times m_n$$

Example 1:

How many different outfits can I wear if I have 5 shirts, 3 pants and 4 shoes to wear?

$$5 \times 3 \times 4 = 60 \; different \; outfits$$

Fundamental Counting Principle

Example 2:

How many different combinations of meals could I order if I could choose from the following:

➢ a soda or juice (2 choices)

➢ a sandwich on a bagel, rye bread or white bread (3 choices)

➢ with cheese, pastrami, roast beef or turkey as a filling? (4 choices)

Answer

2 x 3 x 4 =24 choices

Fundamental Counting Principle illustrated by a Tree Diagram

Example 3 (using a Tree Diagram):

How many different combinations of meals could I order if I could choose from the following:

➢ a soda or juice

➢ a sandwich on a bagel, rye bread or white bread

➢ with cheese, pastrami, roast beef or turkey as a filling?

Fundamental Counting Principle illustrated by a Tree Diagram Example 3 Answer

cheese ———— soda bagel cheese
pastrami ——— soda bagel pastrami
roast beef ——— soda bagel roast beef
turkey ———— soda bagel turkey

cheese ———— soda rye cheese
pastrami ——— soda rye pastrami
roast beef ——— soda rye roast beef
turkey ———— soda rye turkey

cheese ———— soda white cheese
pastrami ——— soda white pastrami
roast beef ——— soda white roast beef
turkey ———— soda white turkey

soda
bagel
rye bread
white bread

cheese ———— juice bagel cheese
pastrami ——— juice bagel pastrami
roast beef ——— juice bagel roast beef
turkey ———— juice bagel turkey

cheese ———— juice rye cheese
pastrami ——— juice rye pastrami
roast beef ——— juice rye roast beef
turkey ———— juice rye turkey

cheese ———— juice white cheese
pastrami ——— juice white pastrami
roast beef ——— juice white roast beef
turkey ———— juice white turkey

juice
bagel
rye bread
white bread

24 combinations

$2 \times 3 \times 4$

$= 24$

Different meals

Example 4:

How many different party packs can be chosen from each of the following:

- BarOne; Kit-Kat; Smarties; Tex; Aero; Nosh; or M&M's (7 choices)
- Coke; Fanta; Cream Soda or Sprite (4 choices)
- Nik-Naks; Lays; or Simba (3 choices)
- Peanut butter or Marmite sandwich (2 choices)

$$7 \times 4 \times 3 \times 2 = 168 \; different \; party \; packs$$

Fundamental Counting Principle

Example 5:

How many possible letter arrangements can be made from the word "MATHS", if:

a) the letters may be repeated?

$$5 \times 5 \times 5 \times 5 \times 5 = 5^5 = 3125$$

b) the letters may NOT be repeated?

$$5 \times 4 \times 3 \times 2 \times 1 = 5! = 120$$

FACTORIAL NOTATION