YEAR 8
KNOWLEDGE ORGANISERS

BLOCK: REPRESENTATIONS

Sets and Probability
Tables and Probability

"MATHS OPENS DOORS"

YEAR 8 — REASONING WITH NUMBER

Sets and probability

What do I need to be able to do?

By the end of this unit you should be able to:

- Identify and represent sets
- Interpret and create Venn diagrams
- Understand and use the intersection of sets
- Understand and use the union of sets
- Generate sample spaces for single events
- Calculate the probability of a single event
- Understand and use the probability scale

Keywords

Bias: a systematic, built-in error which makes all values wrong, or the outcome of an experiment loaded towards a particular outcome.
Element: a member of a set.
Fair: free from bias.
Intersection: the place where two lines cross one another or where two sets overlap.
Mutually exclusive: events that cannot happen at the same time in a probability experiment.
Probability: how likely it is that an event will occur.
Random a chance pick, like drawing a number out of a hat, in which each object has an equal chance of being selected.
Set: a collection of "things" (objects or numbers)
Union: the set made by combining the elements of two sets.

Identify and represent sets

The **universal set** has this symbol ξ — this means EVERYTHING in the Venn diagram is in this set

A set is a collection of things — you write sets inside curly brackets { }

ξ = {the numbers between 1 and 50 inclusive}

My sets can include every number between 1 and 50 including those numbers

A = {Square numbers}

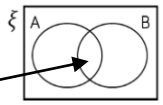
A = {1, 4, 9, 16 ,25, 36, 49}

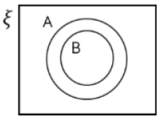
All the numbers in set A are square number and between 1 and 50

Interpret and create Venn diagrams

Mutually exclusive sets
The two sets have nothing in common
No overlap

Union of sets
The two sets have some elements in common — they are placed in the intersection

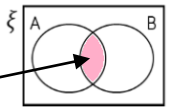




Subset
All of set B is also in Set A so the ellipse fits inside the set

The box
Around the outside of every Venn diagram will be a box. If an element is not part of any set it is placed outside an ellipse but inside the box

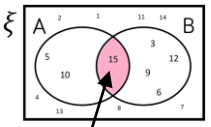
Intersection of sets



Elements in the intersection are in set A AND set B

The notation for this is $A \cap B$

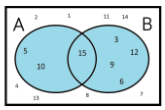
ξ = {the numbers between 1 and 15 inclusive}
A = {Multiples of 5} B = {Multiples of 3}



The element in $A \cap B$ is 15

In this example there is only one number that is both a multiple of 3 and a multiple of 5 between 1 and 15

Union of sets



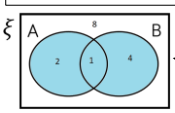
Elements in the union could be in set A OR set B

ξ = {the numbers between 1 and 15 inclusive}
A = {Multiples of 5} B = {Multiples of 3}

The elements in $A \cup B$ are 5, 10, 15, 3, 9, 6, 12

The notation for this is $A \cup B$

There are 7 elements that are either a multiple of 5 OR a multiple of 3 between 1 and 15



This Venn shows the **number of elements** in each set

Sample space — for single events

A sample space for rolling a six-sided dice is S = {1, 2, 3, 4, 5, 6}

A sample space for this spinner is S = {Pink, Blue, Yellow}

You only need to write each element once in a sample space diagram

- A Sample space represents a possible outcome from an event
- They can be interpreted in a variety of ways because they do not tell you the probability

Probability of a single event

Probability = number of times event happens / total number of possible outcomes

P(Blue) = $\frac{4}{10}$ ← There are 4 blue sectors
There are 10 sectors overall

$= \frac{2}{5}$

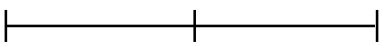
Probability notation P (event)

Probability can be a fraction, decimal or percentage value

$\frac{4}{10} = \frac{40}{100} = 0.40 = 40\%$

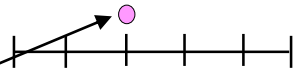
Probability is always a value between 0 and 1

The probability scale



Impossible 0 or 0%
Even chance 0.5, $\frac{1}{2}$ or 50%
Certain 1 or 100%

The more likely an event the further up the probability it will be in comparison to another event (It will have a probability closer to 1)



There are 2 pink and 2 yellow balls, so they have the same probability

There are 5 possible outcomes
So 5 intervals on this scale, each interval value is $\frac{1}{5}$

Sum of probabilities

Probability is always a value between 0 and 1

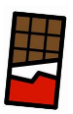
The probability of getting a blue ball is $\frac{1}{5}$
∴The probability of **NOT** getting a blue ball is $\frac{4}{5}$

The sum of the probabilities is 1

The table shows the probability of selecting a type of chocolate

Dark	Milk	White
0.15	0.35	

P(white chocolate) = 1 – 0.15 – 0.35
= 0.5



YEAR 8 - REPRESENTATIONS...

Tables and Probability

What do I need to be able to do?

By the end of this unit you should be able to:

- Construct a sample space diagram.
- Systematically list outcomes.
- Find the probability from two-way tables.
- Find the probability from Venn diagrams.

Keywords

Bias: a systematic, built-in error which makes all values wrong, or the outcome of an experiment loaded towards a particular outcome.
Element: a member of a set.
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Construct sample space diagrams

Sample space diagrams provide a systematic way to display outcomes from events

The possible outcomes from rolling a dice

The possible outcomes from tossing a coin

	1	2	3	4	5	6
H	1,H	2,H	3,H	4,H	5,H	6,H
T	1,T	2,T	3,T	4,T	5,T	6,T

This is the set notation to list the outcomes S =

S = { 1H, 2H, 3H, 4H, 5H, 6H, 1T, 2T, 3T, 4T, 5T, 6T}

In between the { } are a; the possible outcomes

Probability from sample space

The possible outcomes from rolling a dice

The possible outcomes from tossing a coin

	1	2	3	4	5	6
H	1,H	2,H	3,H	4,H	5,H	6,H
T	1,T	(2,T)	3,T	(4,T)	5,T	(6,T)

What is the probability that an outcome has an even number and a tails?

This is the set notation that represents the question P

P (Even number and Tails) = $\frac{3}{12}$

There are three even numbers with tails

There are twelve possible outcomes

Numerator: the event

Denominator: the total number of outcomes

In between the ( ) is the event asked for

Probability from two-way tables

	Car	Bus	Walk	Total
Boys	15	24	14	53
Girls	6	20	(21)	47
Total	21	44	35	(100)

P (Girl walk to school) = $\frac{21}{100}$

The event

The total in the set

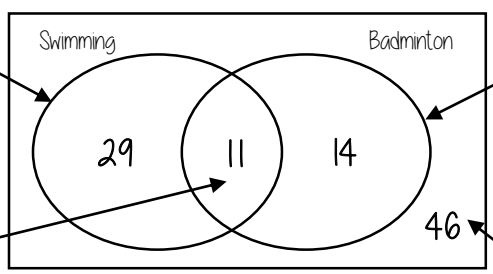
The total number of items

Product Rule

The number of items in event a **X** The number of items in event b

Probability from Venn diagrams

100 students were questioned if they played badminton or went to swimming club.
40 went swimming, 25 went to badminton and 11 went to both.



This whole curve includes everyone that went swimming. Because 11 did both we calculate **just** swimming by 40- 11

This whole curve includes everyone that went to badminton. Because 11 did both we calculate **just** badminton by 25 - 11

The intersection represents both Swimming **AND** badminton

The number outside represents those that did **neither** badminton or swimming

100 – 29 – 11 – 14

P (Just swimming) = $\frac{29}{100}$