

Using set notation



**Year 9
Mathematics**

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Learning Objectives

By the end of the lesson I hope that you understand and can apply the following to a range of questions from the Year 9 Mathematics course.

- Understand how to use set notation to describe different sets of data
- Be able to list sets from a description or diagram
- Be able to interpret symbols used to represent sets of data



Recap of past learning

In the last two lessons we have looked at the basics of probability and how we can find basic probabilities before moving on to be able to express events using Venn Diagrams and Two-Way tables.

Barry, in Australia, and around the world, have decided to make the notation for probability a little confusing! So, this lesson is going to be spent breaking down the confusion by looking at the ways we can express lists and data using mathematical language.



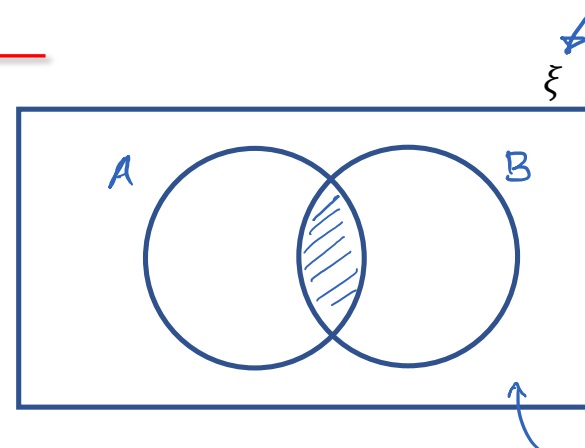
Probability: Sample Space

We have met the sample space before and know it needs to be written inside a set of curly brackets $\{\}$ or it's not going to be given a mark ... but what goes before the brackets?

We have met it previously when looking at Venn Diagrams!

The sample space is sometimes called the **universal set** and is given a number of different symbols:

→ S, Ω, U or ξ



So, for a die we could express it as:

→ $\xi = \{1, 2, 3, 4, 5, 6\}$ →



Probability: Subset

A subset is, as it sounds, a set of numbers within a larger set of numbers.

So, for a die, the sample space would be:

$$\xi = \{1, 2, 3, 4, 5, 6\}$$


And the even numbers could be expressed as:

$$A = \{2, 4, 6\}$$

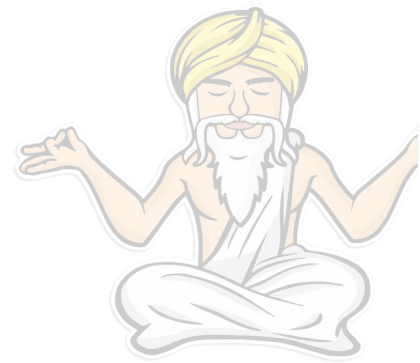

We would have to define A as “the set of even numbers”.



Probability: Contained within

We can express that one set is **contained within** using the following notation:

$$\{2, 4, 6\} \subset \{1, 2, 3, 4, 5, 6\}$$



Probability: Complement and element of

We have already met the idea of the complement of a set or probability.

So, if we had $A = \{2, 4, 6\}$ from a sample space containing the numbers from a standard die, then we could write:

$$A' = \{1, 3, 5\}$$

If we want to say that something is contained within a set, we might say it is an **element** of the set.

Hence, the following would mean that 4 is an element of A .

$$4 \in A$$

$\in$

$$S = \{1, 2, 3, 4, 5, 6\}$$

$$A = \{2, 4, 6\}$$

$$A' = \{1, 3, 5\}$$

$$\text{not } A =$$

$$\bar{A}$$

$$\subset$$



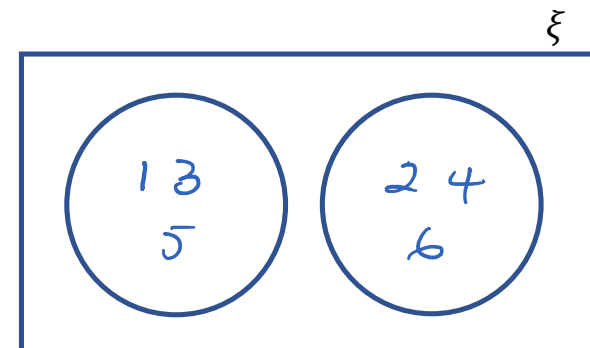
Probability: An empty set

I can't quite fathom why we would need something like this:

A set with no numbers in it would be shown like below:

$$\emptyset = \{ \}$$

This might be described as the overlap between the two circles, i.e. there is no overlap and so there is an empty set of numbers.



$$A : \{1, 3, 5\}$$

$$B : \{2, 4, 6\}$$

$$A \cap B = \emptyset$$
$$= \{ \}$$



Probability: Cardinal number

We have already met the notation below when we express a probability:

$$\Pr(\text{even}) = \frac{1}{2}$$

What if we only want to know the number of items there are in a set? Well, we can express this in the following way:

Where, $A = \{1, 2, 3\}$

$$n(A) = 3$$

↑ ↑ ↑

$$\Pr(\text{even}) = \frac{1}{2}$$

↑



Probability: Intersection

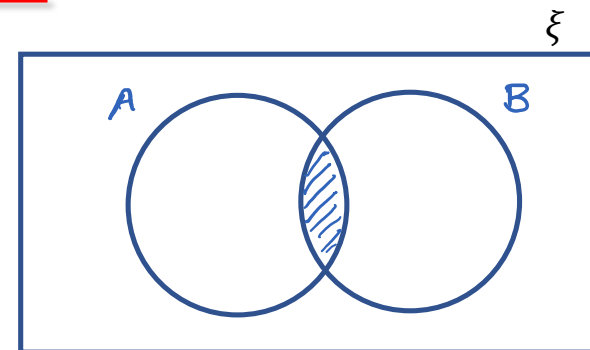
In the previous lesson we looked at using Venn Diagrams to show relationships between sets of numbers.

We saw that, for many cases, there is section of the Venn Diagram which overlaps.

We can use a symbol to describe this overlap:

$$A \cap B$$

The 'n' means intersection. This is where two events share some common information (like numbers).



$$A \cap B$$

intersection
↑

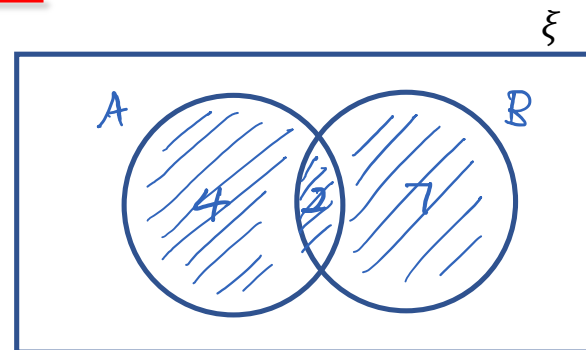


Probability: Union

This is described as all the numbers which, in the Venn Diagram, are in either A or B or both.

We need to take care not to double up on the numbers though!!!!

$$n(A \cup B) = 13$$



Union
↑



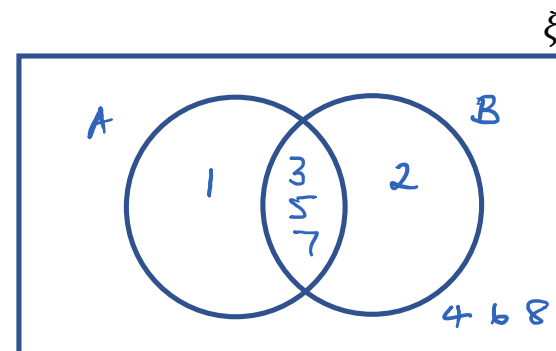
Example

A number is chosen from the set of positive integers between 1 and 8 inclusive. A is the set of odd numbers between 1 and 8 inclusive and B is the set of prime numbers between 1 and 8 inclusive.

List these sets.

- the sample space
- A
- B

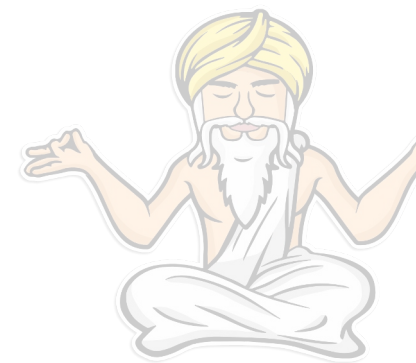
Draw a Venn diagram.



$$\xi = \{1, 2, 3, 4, 5, 6, 7, 8\}$$

$$A = \{1, 3, 5, 7\}$$

$$B = \{2, 3, 5, 7\}$$



Example

A number is chosen from the set of positive integers between 1 and 8 inclusive. A is the set of odd numbers between 1 and 8 inclusive and B is the set of prime numbers between 1 and 8 inclusive.

List these sets.

- $A \cup B$
- $A \cap B$
- A'
- B only

Find:

- $n(A)$
- $\Pr(A)$
- $n(A \cup B)$
- $\Pr(A \cup B)$

$$A \cap B = \{3, 5, 7\}$$

$$\rightarrow A \cup B = \{1, 2, 3, 5, 7\}$$

$$A' = \{2, 4, 6, 8\}$$

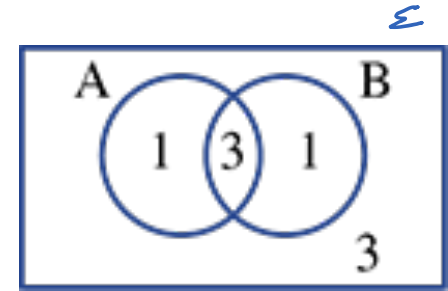
$$B \text{ only} = \{2\}$$

$$n(A) = 4$$

$$\Pr(A) = \frac{4}{8} = \frac{1}{2}$$

$$n(A \cup B) = 5$$

$$\Pr(A \cup B) = \frac{5}{8}$$



$n(A)$

