Probability

$$P(E)$$

This simple statement just says something like "The probability (P) of event E occurring."

The probability of an event happening is calculated in this way:

$$\mathrm{P(E)} = \text{Event probability} = \frac{\text{Number of outcomes of that event}}{\text{Total number of outcomes}}$$

Probability of picking a pink marble:

$$\mathrm{P(E)} = \frac{2}{10} = \frac{1}{5} = 0.2 = 20\%$$

Handy hint – don't double count

If you pick a card at random from a normal 52 card pack, what is the chance that you will pick a red card *or* ace from the pack?

$$\mathrm{P(E)} = \frac{28}{52} = \frac{7}{13} = 0.5385 \approx 54\%$$

There are 26 outcomes that result in a red card being picked, *and a further two outcomes* that result in an ace – two of the aces have *already been counted* in the red cards. Don't double count the red aces.

Not Probabilities

What is a 'not' probability? It's the chance of a certain event *not* happening. The probability of the event happening plus the probability of the event not happening adds together to give 1:

$$\mathrm{P(E)} + \mathrm{P(not\ E)} = 1$$

For example, tomorrow's weather:

$$\mathrm{P(rain)} + \mathrm{P(no\ rain)} = 1$$

Probability Terminology

Example: Bob is picking a single marble out of a bag without looking. There are 10 marbles in the bag – 4 red ones, 3 blue ones, 2 pink ones and 1 white one.

Trial / experiment

This is all about the thing that is happening – in this case the trial or experiment is Bob picking a marble out of the bag.

Outcome

This is the result of what happens when we do the trial or experiment. In this case, the outcome of Bob picking a marble is that he will get a marble with a certain colour.

Outcome space

The *outcome space* is an imaginary space that contains all the possible *outcomes* that you could get from an experiment. An outcome in this experiment is Bob picking a marble of a certain colour. Well, what colours could he get? He could get *red*, *blue*, *pink* and *white*.

Event

Event is used to describe something that happens which you might be interested in. For instance, you might be interested in when Bob picks out a blue marble. The event you're interested in is, "Bob picking out a blue marble."

Probability of an event occurring

We can use the letter 'P' to indicate "probability of", and then inside some brackets after the 'P' write what event we're calculating the probability for. The event is usually represented by the letter 'E'.

Certainties and impossibilities

A certainty is something that has a 100 % chance of happening – it will happen *for sure*:

$$\mathrm{P(certainty)} = 1 \text{ or } 100\%$$

Impossibilities are the opposite of certainties.

$$\mathrm{P(impossibility)} = 0 \text{ or } 0\%$$

Set Language

$$\Pr(E) = \frac{n(E)}{n(A)}$$

- Number of outcomes of that event $= n(E)$
- Total number of outcomes $= n(A)$

Subsets

$$E \subset A$$

The $\subset$ symbol means "is a subset of". This means that the set E is a *subset* (smaller part of) the set A.

'Not' sets

Using proper mathematical notation, we can write "Not E" as:

$$E'$$

Complementary sets

The probability of event E occurring and the probability of it *not* occurring adds up to 1, or 100%. We can talk about these as two sets. Set E contains all the outcomes that result in E happening. The other set, E', contains all the outcomes that *don't* result in E happening.

These are 'complementary' sets. They *complement* each other to make up a total probability of 1.