Probability Facts

Probability is the mathematical chance of an event happening.

$$\text{Probability} = \frac{\text{number of successful outcomes}}{\text{Total number of possible outcomes}}$$

Outcome - all the possibilities from an action e.g. throwing a six sided die will give outcomes of 1, 2, 3, 4, 5 and 6

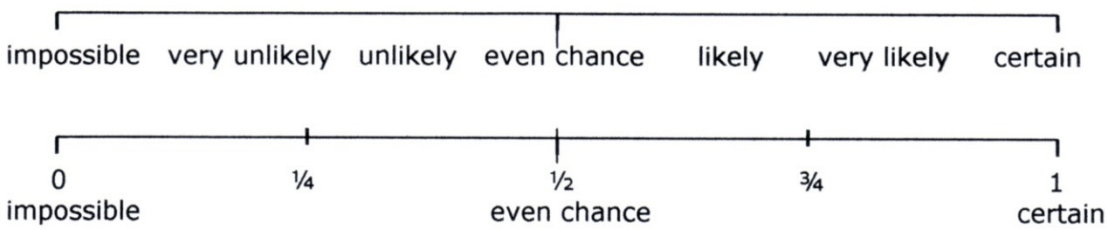
Event – something that can happen e.g. throwing a 6 on a die, flipping a coin and getting a tail

Certain - the probability of an event happening is equal to 1. The event is guaranteed to happen, e.g. the sun will rise tomorrow.

Equally Likely or Evens – there is a probability of 0.5 or equal chance that an event will happen e.g. flipping a head or tail.

Impossible – the probability that an event happens is zero. There is no chance that the event can happen, e.g. if today is Tuesday tomorrow cannot be Saturday.

Probability Scale - the probability scale is between 0 and 1 (or 100%) and can be expressed as a decimal, percentage or a fraction but, NOT as a ratio or betting odds.



Fair - there is an equal chance of all events happening, e.g. the probability of throwing any number on a fair die is equally likely i.e. $\frac{1}{6}$

Bias - the chance of an event happening is not fair e.g. a die may be weighted on one side which will affect the probability of the numbers being thrown.

Experiment - an activity where results can be observed and recorded, e.g. throwing a dice 60 times and recording the outcomes.

Experimental Probability – the chance that there will be a particular outcome from an experiment, e.g. the number of times a 6 is thrown on a dice out of 60 throws. This is also known as relative frequency.

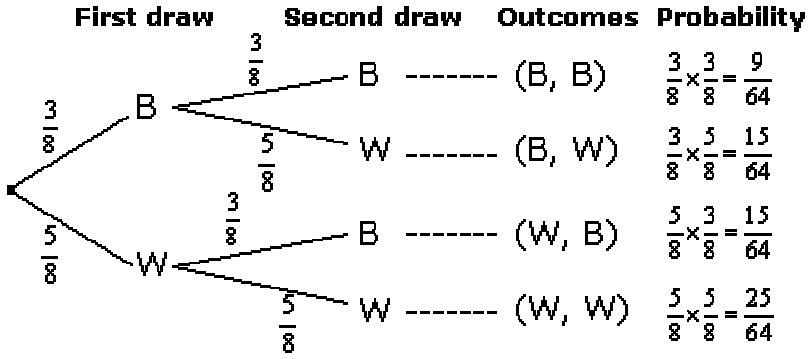
$$\text{Relative Frequency} = \frac{\text{the number of times an event happens}}{\text{the number of attempts}}$$

Theoretical or Expected Probability – is the probability that an event will happen e.g. we would expect the probability of throwing a head or a tail on a fair coin to be $\frac{1}{2}$. However, the actual outcome over a number of throws may not match the expected probability exactly.

Sample Space Diagram – a table to organise possible outcomes to calculate probability e.g. a "sample space diagram" for throwing a coin and a dice:

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

Tree Diagram – helps organise choices and calculate probability, e.g. the probability of picking different combinations of black and white balls from a bag with 3 black balls and 5 white balls.



With Replacement - if picking coloured balls from a bag and replacing them each time then the probability of picking a specific colour at each stage will remain the same because there is always the same number of balls in the bag.

Without Replacement - if picking coloured balls from a bag and the ball picked is not replaced then the probability of the next ball being a certain colour will be affected - see Dependent Events example.

Independent Events - if 2 events are independent of one another this means that the probability of the second event happening is not affected by the outcome of the first event. An example could be spinning a spinner and flipping a coin. The outcome from spinning the spinner does not affect whether a head or tail is thrown when flipping a coin.

Dependent Events - the probability of an event is affected by previous events e.g. picking coloured balls from a bag without replacement. If a black ball is picked and not replaced from a bag with 5 black balls and 5 white balls, the probability of getting a black ball on the second pick will change from $\frac{1}{2}$ to 4/9 and the probability of picking a white ball will change from $\frac{1}{2}$ to 5/9.

Mutually Exclusive Events - these events cannot happen at the same time e.g. a head and a tail cannot be obtained from flipping one coin.

Probability Notes

The **fundamental principle of counting** means that if you have three choices of dessert and four choices of main course then you have 3 x 4 = 12 different menus to choose from.

Probability and chance range from certain to impossible. It can be written with words, percentages fractions or decimals, whereby **0 is impossible and 1 is certain.**

When we use the word **"probability**" in a question our answer will always be a **fraction.**

$$\frac{\textbf{favourable}}{\textbf{number of choices available to us}}$$

If you are asked to do out **a sample space** you need to write down all the possible choices that you have. For example if I write out the sample space for a die then the answer is 1,2,3,4,5,6.

Sometimes we are asked to do two events at the same time. For example what is the sample space for the tossing of a coin and the throwing of a die.

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

We could be asked to answer questions on this sample space.

What is the probability of getting a head with an even number. Answer: $\frac{3}{12}$

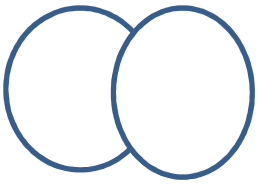
Expected frequency is what I would expect to happen. For example if I toss a coin 100 times I would expect to get 50 heads and 50 tails.

Relative frequency or experimental probability is what actually happens.

When I tossed the coin 100 times I actually got 44 heads and 56 tails.

The more often you carry out the experiment the nearer it will be to what I expected.

Venn diagrams can be used to work out probabilities.



NB:

"AND" means multiply your answers.

"OR" means add your answers.

Tree diagrams can also be used to work out probabilities.