*Conditional probability and independence

Monday, 30 July 2018   6:35 pm

⭐ By the end of the lesson I would hope that you have an understanding of the concepts below and you can apply them to any number of questions which are presented to you:

- What is conditional probability
- What is the formula for conditional probability
- What is the multiplication rule for probability
- What is the law of total probability
- What is an independent event

RECAP:

In a previous less we have spent a lot of time going over the basics of the work which has been presented in Years 7 to 11.
This is all new and so, let's dive straight in …

What is Conditional Probability

conditional probability

noun STATISTICS
noun: conditional probability; plural noun: conditional probabilities
    the probability of an event (*A*), given that another (*B*) has already occurred.

Helpful huh?

In many case, the probability of an event happening has absolutely nothing to do with the outcome of the event before. For example, tossing a fair coin.

It might be that we have situations where the previous result will affect the next result.
For example, the weather.

The probability it rains today given that it rained yesterday will be different from the probability it will rain today given that it didn't rain yesterday.

The formula: Conditional Probability

It's a nice one too …

It's read *"The probability of A happening **given that** B has already happened is the probability that they both happen divided by the probability of B"*

Rearranging it gives us the **multiplication rule of probability.**

Seeing Tree Diagrams in a different way!

You remember those wonderful tree diagrams we have.
Where we toss two coins.
We can now think of them in terms of **conditional probability**.

From the tree diagram we can understand where the **law of total probability** comes from:

Tree Diagrams and Tables

Example of using a table to get the information for conditional probability:

As part of an evaluation of the school canteen, all students at a Senior Secondary College (Years 10–12) were asked to rate the canteen as poor, good or excellent. The results are shown in the table.
What is the probability that a student chosen at random from this college:

Rating	Year 10	Year 11	Year 12	Total
Poor	30	20	10	60
Good	80	65	35	180
Excellent	60	65	35	160
Total	170	150	80	400

a   is in Year 12

b   is in Year 12 and rates the canteen as excellent

c   is in Year 12, given that they rate the canteen as excellent

d   rates the canteen as excellent, given that they are in Year 12?

Independent events

An independent event is one where the probability of a past event has no impact on the probability of a future event. This would perfectly describe my coin toss. The coin does not have any idea of the past outcome and so its future outcome has no bias towards it's last.

Knowing this ... we can see that the we can see the **conditional probability** formula will now become:

And … the **multiplication rule of probability** also becomes:

Example:

The probability that Monica remembers to do her homework is 0.7, while the probability that Patrick remembers to do his homework is 0.4. If these events are independent, then what is the probability that:

a   both will do their homework
b   Monica will do her homework but Patrick forgets?