

## Multiplication Formula

$$P(A \cap B) = P(B|A) \times P(A)$$

The construction  $P(\ )$  represents the “probability of... occurring” so  $P(A)$  is the probability of A occurring.  $P(B|A)$  means the probability of B given that A – or if we know that A is going to happen what is the probability that B will happen, whereas  $P(A \cap B)$  means the probability of both A and B occurring.  $A \cap B$  is the area of overlap between A and B

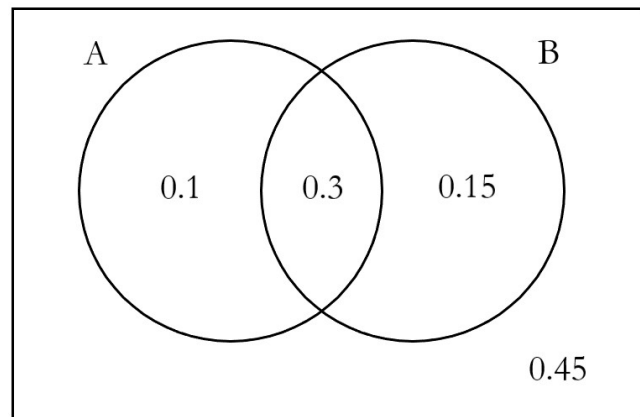
Essentially, this is just a re-arranged version of the definition of  $P(B|A)$ .

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

This is because we have been told A is going to happen, and we want to find the probability B will happen as well as A as a ratio.  $P(A) = 0.1 + 0.3 = 0.4$  and  $P(A \cap B) = 0.3$  so

$$P(B|A) = \frac{0.3}{0.4} = 0.75$$

Meaning that if A is going to happen, 75 times out of 100 B will happen too, which is evidently true.



### Note

$P(A \cap B) = P(A|B) \times P(B)$  is a valid form of this equation also.

### See also

- Addition Formula

### References

Attwood, G. et al. (2017). *Edexcel A level Mathematics - Statistics and Mechanics - Year 2*. London: Pearson Education. p.28.