Probability (AS)

M1	Understand and use mutually exclusive and independent events when calculating probabilities Link to discrete and continuous distributions

Commentary

Many of the aspects related to Probability are covered at GCSE and much of this content is about formalising those ideas. You will want to introduce a range of representations here – Venn Diagrams, Two-way tables and Tree Diagrams as a means of representing events.

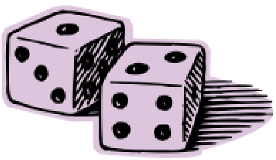
Since the ideas of Conditional Probability are covered in the A2 content, you may wish to define Independent Events as those events A and B which satisfy $P(A \cap B) = P(A) \times P(B)$ rather than $P(A|B) = P(A)$ although there is scope for teaching the AS and A level content together.

The ideas of probability distributions can come from simple experiments involving rolling dice building up to simple Binomial situations involving small values of n. The distribution of probability can be shown in a "line-diagram" and building up a visual idea of the spread of probability from an early stage will help when students move onto the Normal Distribution.

Sample MEI resource

'Thinking about probability' (which can be found at https://my.integralmaths.org/integral/sow-resources.php) is designed for getting to grips with independent and mutually exclusive events.

Thinking About Probability



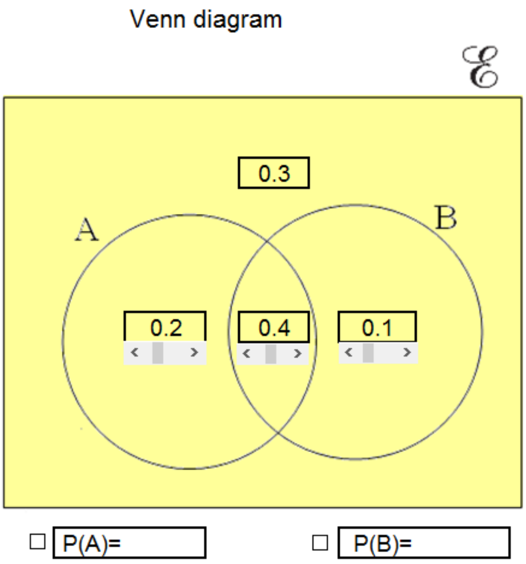
Imagine I roll two dice, one blue and one red and you can't see what the outcome is.

The 36 outcomes can be shown using a possibility space:

		Blue die					
		1	2	3	4	5	6
Red die	1	(1,1) Sum=2	(1,2) Sum=3	(1,3) Sum=4	(1,4) Sum=5	(1,5) Sum=6	(1,6) Sum=7
	2	(2,1) Sum=3	(2,2) Sum=4	(2,3) Sum=5	(2,4) Sum=6	(2,5) Sum=7	(2,6) Sum=8
	3	(3,1) Sum=4	(3,2) Sum=5	(3,3) Sum=6	(3,4) Sum=7	(3,5) Sum=8	(3,6) Sum=9
	4	(4,1) Sum=5	(4,2) Sum=6	(4,3) Sum=7	(4,4) Sum=8	(4,5) Sum=9	(4,6) Sum=10
		(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)

Effective use of technology

'Probability Venn Diagram' (which can be found at www.mei.org.uk/integrating-technology) is designed to investigate Venn Diagrams and the connections between events A, B and $A \cup B$ and $A \cap B$.



Instructions

You can change the three probabilities with sliders below them.
It is not possible for them to total more than one.
If the total gets too big, you will see "X".

If you want to see these probabilities, click on the

Title	**Time allocation:**

Pre-requisites

- GCSE: Calculating simple proportions and probabilities
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Links with other topics

- Binomial distribution: The theory of Independent Events is essential for the Binomial Probability Distribution to work.
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Questions and prompts for mathematical thinking

- Give me an example of a Venn diagram and a tree diagram showing Independent Events A and B.
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Applications and modelling

- Deriving $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ from a Venn Diagram
- Two players take turns to roll a fair dice; the winner is the first person to roll a six. How much of an advantage is it to go first? What if the game is to pick the car hidden behind one of the doors numbered 1 to 6?
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Common errors

- Using $P(A \cap B) = P(A) \times P(B)$for non-independent events
- Using $P(A \cup B) = P(A) + P(B)$for non-mutually exclusive events
- Ensuring that the overall probability adds up to 1, particularly when completing Venn diagrams.
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