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| **UNIT 10: Probability** | **Teaching Time**  7-9 hours |

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**SPECIFICATION REFERENCES**

N5 apply systematic listing strategies, **including use of the product rule for counting** …

P1 record, describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees

P2 apply ideas of randomness, fairness and equally likely events to calculate expected outcomes of multiple future experiments

P3 relate relative expected frequencies to theoretical probability, using appropriate language and the 0–1 probability scale

P4 apply the property that the probabilities of an exhaustive set of outcomes sum to one; apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one

P5 understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size

P6 enumerate sets and combinations of sets systematically, using tables, grids, Venn diagrams and tree diagrams

P7 construct theoretical possibility spaces for single and combined experiments with equally likely outcomes and use these to calculate theoretical probabilities

P8 calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions

P9 **calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams**

**PRIOR KNOWLEDGE**

Students should understand that a probability is a number between 0 and 1, and distinguish between events which are impossible, unlikely, even chance, likely, and certain to occur.

Students should be able to mark events and/or probabilities on a probability scale of 0 to 1.

Students should know how to add and multiply fractions and decimals.

Students should have experience of expressing one number as a fraction of another number.

**KEYWORDS**

Probability, mutually exclusive, conditional, tree diagrams, sample space, outcomes, theoretical, relative frequency, Venn diagram, fairness, experimental

**OBJECTIVES**

By the end of the unit, students should be able to:

* Write probabilities using fractions, percentages or decimals;
* Understand and use experimental and theoretical measures of probability, including relative frequency to include outcomes using dice, spinners, coins, etc;
* Estimate the number of times an event will occur, given the probability and the number of trials;
* Find the probability of successive events, such as several throws of a single dice;
* List all outcomes for single events, and combined events, systematically;
* Draw sample space diagrams and use them for adding simple probabilities;
* Know that the sum of the probabilities of all outcomes is 1;
* Use 1 – *p* as the probability of an event not occurring where *p* is the probability of the event occurring;
* Work out probabilities from Venn diagrams to represent real-life situations and also ‘abstract’ sets of numbers/values;
* Use union and intersection notation;
* Find a missing probability from a list or two-way table, including algebraic terms;
* Understand conditional probabilities and decide if two events are independent;
* Draw a probability tree diagram based on given information, and use this to find probability and expected number of outcome;
* Understand selection with or without replacement;
* Calculate the probability of independent and dependent combined events;
* Use a two-way table to calculate conditional probability;
* Use a tree diagram to calculate conditional probability;
* Use a Venn diagram to calculate conditional probability;
* Compare experimental data and theoretical probabilities;
* Compare relative frequencies from samples of different sizes.

**POSSIBLE SUCCESS CRITERIA**

If the probability of outcomes are *x*, 2*x*, 4*x*, 3*x*, calculate *x*.

Draw a Venn diagram of students studying French, German or both, and then calculate the probability that a student studies French given that they also study German.

**OPPORTUNITIES FOR REASONING/PROBLEM SOLVING**

Students should be given the opportunity to justify the probability of events happening or not happening in real-life and abstract contexts.

**COMMON MISCONCEPTIONS**

Probability without replacement is best illustrated visually and by initially working out probability ‘with’ replacement.

Not using fractions or decimals when working with probability trees.

**NOTES**

Encourage students to work ‘across’ the branches, working out the probability of each successive event. The probability of the combinations of outcomes should = 1.

Use problems involving ratio and percentage, similar to:

* A bag contains balls in the ratio 2 : 3 : 4. A ball is taken at random. Work out the probability that the ball will be … ;
* In a group of students 55% are boys, 65% prefer to watch film *A*, 10% are girls who prefer to watch film *B*. One student picked at random. Find the probability that this is a boy who prefers to watch film *A* (P6).

Emphasise that, were an experiment repeated, it will usually lead to different outcomes, and that increasing sample size generally leads to better estimates of probability and population characteristics.