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| **UNIT 13: Probability**  | **Teaching Time** **11-13 hours** |

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**SPECIFICATION REFERENCES**

N5 apply systematic listing strategies

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

**PRIOR KNOWLEDGE**

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, dependent, independent, conditional, tree diagrams, sample space, outcomes, theoretical, relative frequency, fairness, experimental

**OBJECTIVES**

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

* Distinguish between events which are impossible, unlikely, even chance, likely, and certain to occur;
* Mark events and/or probabilities on a probability scale of 0 to 1;
* Write probabilities in words or fractions, decimals and percentages;
* Find the probability of an event happening using theoretical probability;
* Use theoretical models to include outcomes using dice, spinners, coins;
* List all outcomes for single events systematically;
* Work out probabilities from frequency tables, frequency trees, and two way tables;
* Record outcomes of probability experiments in tables;
* Add simple probabilities;
* Identify different mutually exclusive outcomes and know that the sum of the probabilities of all outcomes is 1;
* Using 1 – *p* as the probability of an event not occurring where *p* is the probability of the event occurring;
* Find a missing probability from a list or table including algebraic terms;
* Find the probability of an event happening using relative frequency;
* Estimate the number of times an event will occur, given the probability and the number of trials – for both experimental and theoretical probabilities;
* List all outcomes for combined events systematically;
* Use and draw sample space diagrams;
* Work out probabilities from Venn diagrams to represent real-life situations and also ‘abstract’ sets of numbers/values;
* Use union and intersection notation;
* Compare experimental data and theoretical probabilities;
* Compare relative frequencies from samples of different sizes;
* Find the probability of successive events, such as several throws of a single dice;
* Use tree diagrams to calculate the probability of two independent events;
* Use tree diagrams to calculate the probability of two dependent events.

**POSSIBLE SUCCESS CRITERIA**

Mark events on a probability scale and use the language of probability.

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

Calculate the probability of an event from a two-way table or frequency table.

Decide if a coin, spinner or game is fair.

Understand the use of the 0–1 scale to measure probability.

List all the outcomes for an experiment.

Know and apply the fact that the sum of probabilities for all outcomes is 1.

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**

Lotteries provides a real life link to probability. Work out the probabilities of winning on different lotteries.

Students should be given the opportunity to justify the probability of events happening or not happening.

**COMMON MISCONCEPTIONS**

Not using fractions or decimals when working with probability trees.

**NOTES**

Use this as an opportunity for practical work.

Probabilities written in fraction form should be cancelled to their simplest form.

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

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

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.

Probabilities written in fraction form should be cancelled to their simplest form.