Key focus

This is the introductory Master Guide entry for basic (theoretical) probability, building on the Year 9 probability objectives before moving into the granular Year 10 sequence (fraction/decimal/percentage probability, expected outcome, frequency tables, tree diagrams, two-way tables). Students learn to describe likelihood in everyday language on a 0-to-1 scale, distinguish theoretical probability (calculated from a sample space) from experimental probability (based on trial results), and calculate a basic probability as favourable outcomes over total outcomes using dice, spinners, cards, and counters.

Suggested teaching sequence

1. Introduce the 0-to-1 probability scale with everyday likelihood language before any calculation: Impossible ($P = 0$), Unlikely, Even chance ($P = 0.5$), Likely, Certain ($P = 1$).
2. Practise placing familiar events on the scale and describing them in words (e.g. "rolling a 7 on a standard die" is impossible; "the sun rising tomorrow" is certain).
3. Introduce the sample space: the complete list of possible outcomes of an experiment (die faces, spinner sections, cards in a deck, counters in a bag).
4. Define theoretical probability as favourable outcomes ÷ total outcomes, calculated from the sample space without needing to run the experiment.
5. Introduce experimental probability: the proportion of favourable results actually observed over a number of trials. Emphasise that experimental results vary between repeated trials, even when the underlying theoretical probability is fixed (a coin landing heads 3 times in a row does not mean it's unfair).
6. Practise expressing a basic probability as a fraction, a decimal, and a percentage, and confirm they all represent the same value.
7. Introduce the complement rule ($P(\text{not } A) = 1 - P(A)$), and the ideas that mutually exclusive event probabilities add (they cannot both happen) while independent event probabilities multiply (one does not affect the other).
8. Discuss why a calculated probability must always be between 0 and 1 inclusive – a result outside that range signals an arithmetic or reasoning error.

Core examples to model

- Scale language: rolling a 7 on a standard die is Impossible ($P = 0$); a fair coin landing heads is an Even chance ($P = 0.5$).
- Basic probability: a fair 6-sided die has sample space $\{1, 2, 3, 4, 5, 6\}$, so $P(\text{any one face}) = \frac{1}{6}$.
- Fraction/decimal/percentage: a bag with 3 red and 7 blue counters gives $P(\text{red}) = \frac{3}{10} = 0.3 = 30\%$.

- Theoretical vs experimental: theoretically $P(6) = \frac{1}{6}$ on a fair die; rolling it 60 times might record 8, 12, or 9 sixes rather than exactly 10, due to ordinary variation.
- Complement: if $P(\text{red}) = 0.3$ in a bag of only red and blue counters, then $P(\text{blue}) = 1 - 0.3 = 0.7$.

Watch for

- Treating a small number of experimental trials as proof a fair object is biased (e.g. 3 heads in a row does not mean a coin is unfair).
- Forgetting that probabilities must lie between 0 and 1 inclusive – a probability greater than 1 or negative signals an error, most often from double-counting or miscounting the sample space.
- Double-counting an outcome that belongs to two described events (e.g. the King of Hearts is both a heart and a King) when finding $P(A \text{ or } B)$.
- Confusing mutually exclusive events (cannot both happen – probabilities add) with independent events (one does not affect the other – probabilities multiply); these are different ideas that are easy to mix up.
- Assuming every event has an equal chance without checking the sample space is genuinely equally likely (e.g. an unequal spinner, or drawing without replacement).

Checks for understanding

- Can students place an event on a 0-to-1 probability scale and describe it using everyday likelihood language?
- Can they explain the difference between theoretical and experimental probability, and why experimental results vary between trials?
- Can they identify a sample space and use it to calculate a basic probability as favourable over total outcomes?
- Can they express a probability as a fraction, decimal, and percentage?
- Can they apply the complement rule, and distinguish mutually exclusive from independent events?
- Can they explain why a calculated probability must lie between 0 and 1?