Exercise walk-through

5.1
Probability basics and tables (P1–P6)

AQA · GCSE · Mathematics

The probability scale and outcomes

- The probability of an event is a number from 0 to 1 on the **probability scale** . 0 means impossible, 1 means certain, and 0.5 means an even chance.
- Write probabilities as fractions, decimals or percentages, never as "1 in 4" or "1 : 4".
- When every **outcome** is **equally likely** , the **theoretical probability** is
- For a fair six-sided die, $P(\text{even}) = \frac{3}{6} = \frac{1}{2}$.

$$P(\text{event}) = \frac{\text{number of outcomes in the event}}{\text{total number of outcomes}}$$

Experiments and expected frequency

- When outcomes are not **equally likely**, such as a drawing pin landing point up, we estimate the probability by experiment.
- The **relative frequency** is
- A larger **sample size** gives a better estimate.
- Six heads in 10 tosses gives 0.6, but 502 heads in 1000 tosses gives 0.502, much closer to the true 0.5 of a fair coin.

$$\text{relative frequency} = \frac{\text{number of times the event happened}}{\text{number of trials}}$$

Conditional probability (H)

- A **conditional probability** is the probability of an event when you already know that another event has happened.
- $P(A \mid B)$ means "the probability of A, given B".
- Knowing B shrinks the group you count from to just the members of B:
- **Worked example 9 (H).** In the class of 30 (18 cycle, 12 swim, 7 both), $P(\text{swims} \mid \text{cycles}) = \frac{7}{18}$, because only the 18 cyclists count.

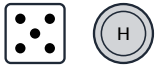
$$P(A \mid B) = \frac{P(A \text{ and } B)}{P(B)}$$

Exercises 2.1–2.3

2.1 Write 0.35 as a fraction in its simplest form. [1]



2.2 Red, blue and green are exhaustive, mutually exclusive outcomes with $P(\text{red}) = 0.3$ and $P(\text{blue}) = 0.45$. Find $P(\text{green})$. [2]



2.3 A spinner lands red 18 times in 60 spins. (a) Estimate $P(\text{red})$. (b) How many reds are expected in 200 future spins? [2]



Exercises 2.1–2.3

2.1 Write 0.35 as a fraction in its simplest form. [1]



2.1 $0.35 = \frac{35}{100} = \frac{7}{20}$.

2.2 Red, blue and green are exhaustive, mutually exclusive outcomes with $P(\text{red}) = 0.3$ and $P(\text{blue}) = 0.45$. Find $P(\text{green})$. [2]



2.2 $1 - 0.3 - 0.45 = 0.25$.

2.3 A spinner lands red 18 times in 60 spins. (a) Estimate $P(\text{red})$. (b) How many reds are expected in 200 future spins? [2]



2.3 (a) $\frac{18}{60} = 0.3$. (b) $200 \times 0.3 = 60$ reds.

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Exercise 2.4

2.4 A fair coin and a fair die are rolled together. List the sample space and find $P(\text{head and even})$. [3]



2.5 Two fair dice are rolled. Find $P(\text{total is } 7)$. [2]



2.6 In a class of 30, 18 cycle, 12 swim and 7 do both. Find the number who do at least one, and the number who do neither. [3]



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2.4 Twelve ordered outcomes H1–H6 and T1–T6; head-and-even has three (H2, H4, H6): $P = \frac{3}{12} = \frac{1}{4}$.

Full solution on next slide

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Full solution 2.4

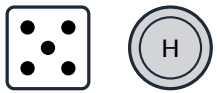
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2.5 Six pairs sum to 7 – (1,6), (2,5), (3,4), (4,3), (5,2), (6,1) – of 36: $P = \frac{6}{36} = \frac{1}{6}$.

2.6 Cycling only $18 - 7 = 11$; swimming only $12 - 7 = 5$; at least one $= 11 + 7 + 5 = 23$; neither $= 30 - 23 = 7$.

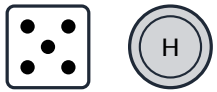
Exercise 3.1

3.1 *(June 2024 2H Q7, adapted.)* Four students each flip a coin a different number of times; one obtains 52 heads in 200 flips. Whose result is the best estimate of $P(\text{head})$, and why? [2]



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3.1 $\frac{52}{200}$ – it uses the largest number of flips, so it is the most stable estimate.

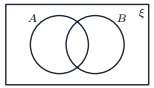
Exercise 3.2

3.2 *(June 2024 2H Q4(b), adapted.)* A spinner's claimed outcome probabilities are 0.1, 0.5, 0.2 and 0.3. Give one reason why there must be a mistake. [2]

3.3 *(June 2024 3H Q10, adapted.)* The probability that it rains on a day is 0.38. Of 150 days, how many are expected to be dry? [3]

3.4 *(June 2024 3H Q22, adapted.)* A code uses four DIFFERENT digits chosen from five digits. Work out the number of possible codes. [2]

3.5 *(June 2024 2H Q9, adapted.)* Two sets A and B are drawn as a Venn diagram inside a rectangle. Describe, in words, exactly which region must be shaded to show "both A and B". [1]



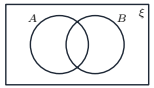
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3.2 The probabilities sum to $0.1 + 0.5 + 0.2 + 0.3 = 1.1$, not 1 – an exhaustive set of mutually exclusive outcomes must sum to 1.

3.3 $P(\text{dry}) = 1 - 0.38 = 0.62$; expected $= 0.62 \times 150 = 93$ days.

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3.4 $5 \times 4 \times 3 \times 2 = 120$ codes – one fewer choice at each stage because digits cannot repeat.

3.5 The intersection – the overlap lens of the two circles only.

Local review guidance: probability values justified by trials or by the sum-to-1 property; sample spaces listed before dividing counts; expected counts stated as whole numbers with the $n \times p$ route shown. This is authored classroom guidance.