

Exercise walk-through

5.1

Probability basics and tables (P1–P6)

AQA · GCSE · Mathematics

1. Unit 3.5 at a glance

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Foundation rows P1-P9 in three tiers. Additional foundation: empirical unbiased samples tending toward theory (P5), tree diagrams (P6) and independent plus DEPENDENT combined events with their assumptions (P8). Higher only: conditional probability through expected frequencies with two-way tables, trees and Venn diagrams (P9).

Must-know: probabilities on the 0-to-1 scale; exhaustive mutually exclusive outcomes sum to 1; relative frequency = occurrences over trials; expected count = n times p ; multiply along tree paths, add disjoint paths; $P(A \text{ given } B) = P(A \text{ and } B) \text{ over } P(B)$.

2. Experiments, frequency and expectation

Experiments, frequency and expectation

Record outcome frequencies with tables and frequency trees (P1); probabilities as fractions, decimals or percentages. Expected outcomes of multiple future experiments (P2): expected count = n times p - a spinner red 18 times in 60 spins estimates 0.3, so 200 future spins expect 60 reds. The 3H Q10 anchor: rain 0.38 gives dry $0.62 \times 150 = 93$ of 150 days.

Empirical unbiased samples tend toward the theoretical distribution as sample size grows (P5) - 6 heads in 10 estimates 0.6, 502 in 1000 estimates 0.502. The 2H Q7 anchor: the best estimate of $P(\text{head})$ is $52/200$ because it uses the largest number of flips.

Check yourself

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Frequency tables and trees; the probability scale; expected counts n times p ; exhaustive sums to 1; empirical samples tending to theory.

Systematic listing with grids, Venn diagrams and trees; equally likely possibility spaces; combined events with and without replacement and the complement route.

Conditional probability with two-way tables, trees and Venn diagrams via expected frequencies.

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.

Exercises 2.4·2.6

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]

Exercises 2.4·2.6

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

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

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

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 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]

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

Exercises 3.1·3.3

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]

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. [3]

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]

Exercises 3.1·3.3

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]

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

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]

3.2 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 (*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]

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

Exercises 3.4·3.5

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]

Exercises 3.4·3.5

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]

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

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]

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.