

Exercise walk-through

6.4

Probability foundations

Pearson Edexcel · International GCSE · Mathematics A

1. Topic 6 at a glance

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Foundation 6.1-6.3: presenting data, averages with grouped estimates, and the probability toolkit. Higher adds unequal-class histograms, cumulative frequency with quartiles, and tree diagrams for independent and conditional events.

Must-know: grouped mean via midpoints; density is frequency over width, AREA is frequency; ogive reads at $n/2$, $n/4$, $3n/4$; $P(A') = 1 - P(A)$; $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$; trees multiply along, add between.

5. Probability foundations

Probability foundations

Scale 0 to 1; theoretical counts equally likely outcomes, experimental divides successes by trials. Sample spaces list outcomes - grids for two events; complements turn 'at least one' into one minus none.

Venn regions sum to the total: 30 students, 18 cricket, 15 tennis, 7 both gives $P(\text{neither}) = 1 - 26/30 = 2/15$, through $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$.

6. Trees and combined events

Trees and combined events

Multiply along a path, add between paths. With replacement the branches repeat (independent); without replacement the second denominator drops by one and the numerator adjusts.

June 2024 1HR Q21 family: 5 red, 6 blue, 9 green, two draws without replacement - one of each of red/blue either way is $\frac{5}{20} \times \frac{6}{19} + \frac{6}{20} \times \frac{5}{19} = \frac{3}{19}$. The paper's unknown-x version ends in a quadratic ($x = 11$, probability $\frac{7}{75}$). Conditional reads off the branch: $P(\text{blue second given red first}) = \frac{6}{19}$.

Exercises 2.1·2.3

2.1 A spinner lands on red 23 times in 100 spins. Estimate $P(\text{red})$. [1]

2.2 List the sample space for rolling two dice and total the ways to score 8. [2]

2.3 If $P(\text{rain}) = 0.3$, find $P(\text{no rain})$ [1]

Exercises 2.1·2.3

2.1 A spinner lands on red 23 times in 100 spins. Estimate $P(\text{red})$. [1]

2.1 $23/100 = 0.23$.

2.2 List the sample space for rolling two dice and total the ways to score 8. [2]

2.2 36 ordered pairs; total 8: $(2, 6), (3, 5), (4, 4), (5, 3), (6, 2)$ – 5 ways.

2.3 If $P(\text{rain}) = 0.3$, find $P(\text{no rain})$ [1]

2.3 $1 - 0.3 = 0.7$.

Exercises 2.4·3.2

2.4 In a class of 25, 14 play football, 11 basketball, 5 both. Draw or describe the Venn regions and find $P(\text{neither})$ [3]

3.1 (*Original.*) Two fair coins are tossed. (a) List the sample space. (b) Find $P(\text{exactly one head})$. (c) Find $P(\text{at least one tail})$, using the complement. [4]

3.2 (*Original.*) A card is drawn from a standard 52-card deck. Find $P(\text{heart})$, $P(\text{king})$, $P(\text{heart or king})$, showing the overlap subtraction. [4]

Exercises 2.4·3.2

2.4 In a class of 25, 14 play football, 11 basketball, 5 both. Draw or describe the Venn regions and find $P(\text{neither})$ [3]

2.4 Football only 9, both 5, basketball only 6, neither $25 - 20 = 5$; $P(\text{neither}) = 5/25 = 1/5$.

3.1 (*Original.*) Two fair coins are tossed. (a) List the sample space. (b) Find $P(\text{exactly one head})$. (c) Find $P(\text{at least one tail})$, using the complement. [4]

3.1 (a) HH, HT, TH, TT. (b) 2 of 4: $\frac{1}{2}$. (c) $P(\text{no tail}) = \frac{1}{4}$, so $P(\text{at least one tail}) = 1 - \frac{1}{4} = \frac{3}{4}$.

3.2 (*Original.*) A card is drawn from a standard 52-card deck. Find $P(\text{heart})$, $P(\text{king})$, $P(\text{heart or king})$, showing the overlap subtraction. [4]

3.2 $P(\text{heart}) = \frac{13}{52} = \frac{1}{4}$; $P(\text{king}) = \frac{4}{52} = \frac{1}{13}$; $P(\text{heart or king}) = \frac{13+4-1}{52} = \frac{16}{52} = \frac{4}{13}$ (the king of hearts counted once).

Exercise 3.3

3.3 (*Original.*) A survey of 40 people: 22 read paper A, 18 paper B, 7 read both, and 7 read neither. (a) Verify the four Venn regions total 40. (b) A reader of paper A is chosen at random: find the probability they also read B. [4]

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3.3 (a) A only $22 - 7 = 15$, both 7, B only $18 - 7 = 11$, neither 7: total $15 + 7 + 11 + 7 = 40$.
✓ (b) $P(B \mid A) = \frac{7}{22}$ – 7 of the 22 A-readers.

Local review guidance: the sample space or Venn regions listed before any fraction; simplified probabilities; complement reasoning stated, not just applied. This is authored classroom guidance.