

GCSE MATHEMATICS

FOUNDATION TIER

COMPREHENSIVE LESSON NOTEBOOK

UNIT 5 | PROBABILITY

TEACH-FROM-SCRATCH • PUBLICATION EDITION

8 detailed chapters • original diagrams • worked examples • guided practice • answers

INDEPENDENT PUBLICATION NOTICE

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COMPREHENSIVE LESSON NOTEBOOK

How to learn from this notebook

Meaning first. Method second. Practice third.

FIVE-PASS ROUTINE

1 Read the key idea without a calculator. 2 Cover each worked solution and reproduce it. 3 Complete practice independently. 4 Mark in a different colour and repair errors. 5 Retest after 2-7 days.

What a complete mathematics answer contains

- A clear model or calculation, not only a calculator display.
- Enough working for another person to follow the reasoning.
- Exact values until approximation is requested.
- Units and sensible rounding in context.
- A final statement when interpretation is required.

Error loop

REPAIR, DO NOT MERELY CORRECT

Label each error: concept, operation, arithmetic, calculator entry, accuracy, unit or interpretation. Write the corrected step and one sentence explaining the change.

Foundation does not mean superficial

Eduqas Foundation questions can combine familiar skills in unfamiliar contexts. Grade 4-5 success depends on selecting a method, connecting several steps and deciding whether the answer is reasonable.

COMPREHENSIVE LESSON NOTEBOOK

Unit 5 coverage map

Eduqas C300 Foundation Probability content organised into a teachable sequence.

CH 01	Eduqas C300 FP1	Experimental frequency and frequency trees
CH 02	Eduqas C300 FP2	Randomness, fairness and expected outcomes
CH 03	Eduqas C300 FP3	Relative frequency and the probability scale
CH 04	Eduqas C300 FP4	Exhaustive and mutually exclusive outcomes
CH 05	Eduqas C300 FP5	Sample size and reliable probability estimates
CH 06	Eduqas C300 FP6	Systematic listing and probability diagrams
CH 07	Eduqas C300 FP7	Possibility spaces and theoretical probability
CH 08	Eduqas C300 FP8	Independent and dependent combined events

IMPORTANT TIER NOTE

This notebook covers Eduqas C300 references FP1-FP8 at Foundation Tier: experimental probability, fairness, systematic enumeration, possibility spaces and combined events. Specification references are identifiers, not copied specification wording.

COMPREHENSIVE LESSON NOTEBOOK

Fast-reference method bank

Understand each relationship before memorising it.

Probability scale

$$0 \leq P(A) \leq 1$$

Complement

$$P(\text{not } A) = 1 - P(A)$$

Equally likely

favourable outcomes / total outcomes

Relative frequency

event frequency / number of trials

Expected frequency

trials x probability

Mutually exclusive

add probabilities for A or B

Union count

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

Tree route

multiply along branches

Alternative routes

add mutually exclusive paths

Without replacement

update numerator and denominator

CURRENT ASSESSMENT NOTE

Eduqas states that an additional formula sheet is integrated into examination papers from Summer 2026. Check the official Eduqas qualification page for the arrangement applying to your examination series.

COMPREHENSIVE LESSON NOTEBOOK

Experimental frequency and frequency trees

Record, describe and analyse outcomes from experiments using tables and frequency trees.

SPECIFICATION FOCUS

Specification reference Eduqas C300 FP1. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Experimental data estimate probability by comparing an event count with the complete number of trials.

KEY VOCABULARY

frequency • relative frequency • outcome • trial • frequency tree



observed proportion compared with expected proportion

Why the method works

- The representation accounts for the complete set of possible outcomes.
- Addition combines non-overlapping alternatives; multiplication follows a sequence.
- Complements, branch totals and the 0-to-1 range provide independent checks.

CHECK BEFORE MOVING ON

Answer mentally: A spinner is tested 50 times and lands on blue 12 times. Find the experimental probability of blue in simplest form. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Experimental frequency and frequency trees - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Frequency records how often an outcome occurs; relative frequency divides by the total trials.
- In a frequency tree, every parent total equals the sum of its branches.
- Label branches with counts first, then convert to probabilities only when required.

WORKED EXAMPLE 1

A spinner is tested 50 times and lands on blue 12 times. Find the experimental probability of blue in simplest form.

SOLUTION

1. Relative frequency = blue outcomes / total trials = $12/50 = 6/25$.

ANSWER: 6/25

WORKED EXAMPLE 2

In 70 trials, red occurs 20 times and blue occurs 24 times. Complete the frequency total for all other outcomes and find its relative frequency.

SOLUTION

1. Other outcomes = $70 - 20 - 24 = 26$. Relative frequency = $26/70 = 13/35$.

ANSWER: 26; 13/35

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Experimental frequency and frequency trees - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

quality testing use probability models to support decisions while acknowledging uncertainty.

Common misconceptions

- Assuming outcomes are equally likely without evidence.
- Adding probabilities when a sequential route requires multiplication.
- Double-counting overlap or failing to update a dependent trial.

GUIDED TRY

A frequency tree starts with 85 learners. 45 pass test 1 and 28 pass both tests. How many pass test 1 but not test 2? First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

In 100 trials, red occurs 26 times and blue occurs 30 times. Complete the frequency total for all other outcomes and find its relative frequency. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Experimental frequency and frequency trees

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. A spinner is tested 50 times and lands on blue 12 times. Find the experimental probability of blue in simplest form. [2]

2. In 70 trials, red occurs 20 times and blue occurs 24 times. Complete the frequency total for all other outcomes and find its relative frequency. [3]

3. A frequency tree starts with 85 learners. 45 pass test 1 and 28 pass both tests. How many pass test 1 but not test 2? [3]

4. A spinner is tested 80 times and lands on blue 18 times. Find the experimental probability of blue in simplest form. [2]

5. In 85 trials, red occurs 23 times and blue occurs 27 times. Complete the frequency total for all other outcomes and find its relative frequency. [3]

6. A frequency tree starts with 100 learners. 48 pass test 1 and 31 pass both tests. How many pass test 1 but not test 2? [3]

7. A spinner is tested 110 times and lands on blue 24 times. Find the experimental probability of blue in simplest form. [2]

8. In 100 trials, red occurs 26 times and blue occurs 30 times. Complete the frequency total for all other outcomes and find its relative frequency. [3]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Randomness, fairness and expected outcomes

Apply randomness, fairness and equally likely outcomes to repeated experiments.

SPECIFICATION FOCUS

Specification reference Eduqas C300 FP2. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Fairness is a property of the probability model; expected frequency converts that model into a predicted long-run count.

KEY VOCABULARY

random • fair • equally likely • expected frequency • variation



observed proportion compared with expected proportion

Why the method works

- The representation accounts for the complete set of possible outcomes.
- Addition combines non-overlapping alternatives; multiplication follows a sequence.
- Complements, branch totals and the 0-to-1 range provide independent checks.

CHECK BEFORE MOVING ON

Answer mentally: A bag contains 3 red and 4 blue counters. A counter is replaced after every draw. In 60 draws, calculate the expected number of reds. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Randomness, fairness and expected outcomes - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- A fair device gives equally likely basic outcomes.
- Expected frequency equals number of trials multiplied by probability.
- An expected count is a long-run prediction, not a guaranteed result.

WORKED EXAMPLE 1

A bag contains 3 red and 4 blue counters. A counter is replaced after every draw. In 60 draws, calculate the expected number of reds.

SOLUTION

1. $P(\text{red}) = \frac{3}{7}$. Expected frequency $= 60 \times \frac{3}{7} = 180/7$.

ANSWER: 180/7

WORKED EXAMPLE 2

A spinner has 7 equal sectors labelled 1, 2, 3, 4, 5, 6, 7. Explain why it is fair for selecting one label and state $P(\text{label } 7)$.

SOLUTION

1. A fair spinner gives each of its 7 equal sectors probability $\frac{1}{7}$.

ANSWER: Equal sectors make outcomes equally likely; $\frac{1}{7}$

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Randomness, fairness and expected outcomes - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

games and forecasting use probability models to support decisions while acknowledging uncertainty.

Common misconceptions

- Assuming outcomes are equally likely without evidence.
- Adding probabilities when a sequential route requires multiplication.
- Double-counting overlap or failing to update a dependent trial.

GUIDED TRY

A standard fair die is rolled 60 times and produces 19 sixes. Does this result prove that the die is biased? Explain. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

A spinner has 13 equal sectors labelled 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13. Explain why it is fair for selecting one label and state $P(\text{label } 13)$. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Randomness, fairness and expected outcomes

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. A bag contains 3 red and 4 blue counters. A counter is replaced after every draw. In 60 draws, calculate the expected number of reds. [3]

2. A spinner has 7 equal sectors labelled 1, 2, 3, 4, 5, 6, 7. Explain why it is fair for selecting one label and state $P(\text{label } 7)$. [3]

3. A standard fair die is rolled 60 times and produces 19 sixes. Does this result prove that the die is biased? Explain. [3]

4. A bag contains 6 red and 7 blue counters. A counter is replaced after every draw. In 90 draws, calculate the expected number of reds. [3]

5. A spinner has 10 equal sectors labelled 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. Explain why it is fair for selecting one label and state $P(\text{label } 10)$. [3]

6. A standard fair die is rolled 60 times and produces 22 sixes. Does this result prove that the die is biased? Explain. [3]

7. A bag contains 9 red and 10 blue counters. A counter is replaced after every draw. In 120 draws, calculate the expected number of reds. [3]

8. A spinner has 13 equal sectors labelled 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13. Explain why it is fair for selecting one label and state $P(\text{label } 13)$. [3]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Relative frequency and the probability scale

Relate experimental relative frequency to theoretical probability and use the 0-to-1 scale.

SPECIFICATION FOCUS

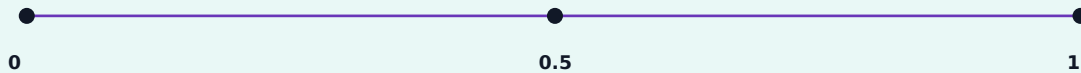
Specification reference Eduqas C300 FP3. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

The 0-to-1 scale provides one common language for fractions, decimals, percentages and verbal likelihood.

KEY VOCABULARY

probability scale • impossible • even chance • certain • complement



Why the method works

- The representation accounts for the complete set of possible outcomes.
- Addition combines non-overlapping alternatives; multiplication follows a sequence.
- Complements, branch totals and the 0-to-1 range provide independent checks.

CHECK BEFORE MOVING ON

Answer mentally: An event occurs 14 times in 44 trials. Estimate its probability and describe it as impossible, unlikely, even chance, likely or certain. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Relative frequency and the probability scale - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Probability lies from 0 to 1 inclusive.
- Experimental probability is event frequency divided by total trials.
- Compare estimates only after writing them in the same form.

WORKED EXAMPLE 1

An event occurs 14 times in 44 trials. Estimate its probability and describe it as impossible, unlikely, even chance, likely or certain.

SOLUTION

1. Estimated probability = $14/44 = 7/22$. Compare this value with 0, $1/2$ and 1.

ANSWER: $7/22$; unlikely

WORKED EXAMPLE 2

Place the probability $3/10$ on a 0-to-1 scale and state whether its complement is more or less likely.

SOLUTION

1. The complement is $1 - 3/10 = 7/10$. Compare the two probabilities.

ANSWER: At 0.3; complement $7/10$, more likely

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Relative frequency and the probability scale - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

risk communication use probability models to support decisions while acknowledging uncertainty.

Common misconceptions

- Assuming outcomes are equally likely without evidence.
- Adding probabilities when a sequential route requires multiplication.
- Double-counting overlap or failing to update a dependent trial.

GUIDED TRY

The theoretical probability of an outcome is $\frac{1}{5}$. In 160 trials it occurs 33 times. Find the relative frequency and compare it with the theoretical value. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Place the probability $\frac{1}{10}$ on a 0-to-1 scale and state whether its complement is more or less likely. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Relative frequency and the probability scale

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. An event occurs 14 times in 44 trials. Estimate its probability and describe it as impossible, unlikely, even chance, likely or certain. [3]

2. Place the probability $\frac{3}{10}$ on a 0-to-1 scale and state whether its complement is more or less likely. [3]

3. The theoretical probability of an outcome is $\frac{1}{5}$. In 160 trials it occurs 33 times. Find the relative frequency and compare it with the theoretical value. [4]

4. An event occurs 20 times in 56 trials. Estimate its probability and describe it as impossible, unlikely, even chance, likely or certain. [3]

5. Place the probability $\frac{3}{5}$ on a 0-to-1 scale and state whether its complement is more or less likely. [3]

6. The theoretical probability of an outcome is $\frac{1}{5}$. In 220 trials it occurs 43 times. Find the relative frequency and compare it with the theoretical value. [4]

7. An event occurs 26 times in 68 trials. Estimate its probability and describe it as impossible, unlikely, even chance, likely or certain. [3]

8. Place the probability $\frac{1}{10}$ on a 0-to-1 scale and state whether its complement is more or less likely. [3]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Exhaustive and mutually exclusive outcomes

Use the fact that probabilities of exhaustive, mutually exclusive outcomes sum to 1.

SPECIFICATION FOCUS

Specification reference Eduqas C300 FP4. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

A complete set of non-overlapping outcomes partitions the whole probability of 1.

KEY VOCABULARY

exhaustive • mutually exclusive • complement • total • event

$$P(A) + P(\text{not } A) = 1$$

all exhaustive outcomes complete the whole

Why the method works

- The representation accounts for the complete set of possible outcomes.
- Addition combines non-overlapping alternatives; multiplication follows a sequence.
- Complements, branch totals and the 0-to-1 range provide independent checks.

CHECK BEFORE MOVING ON

Answer mentally: Three mutually exclusive outcomes A, B and C are exhaustive. $P(A)=1/5$ and $P(B)=1/4$. Find $P(C)$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Exhaustive and mutually exclusive outcomes - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Exhaustive outcomes cover every possibility.
- Mutually exclusive outcomes cannot happen together in one trial.
- Complementary probabilities add to 1.

WORKED EXAMPLE 1

Three mutually exclusive outcomes A, B and C are exhaustive. $P(A)=1/5$ and $P(B)=1/4$. Find $P(C)$.

SOLUTION

1. Exhaustive mutually exclusive probabilities total 1, so $P(C)=1-1/5-1/4=11/20$.

ANSWER: 11/20

WORKED EXAMPLE 2

$P(\text{rain})=3/8$. Find $P(\text{no rain})$ and name the probability rule used.

SOLUTION

1. Rain and no rain are complementary, so $P(\text{no rain})=1-3/8=5/8$.

ANSWER: 5/8; complementary outcomes sum to 1

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Exhaustive and mutually exclusive outcomes - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

weather and reliability use probability models to support decisions while acknowledging uncertainty.

Common misconceptions

- Assuming outcomes are equally likely without evidence.
- Adding probabilities when a sequential route requires multiplication.
- Double-counting overlap or failing to update a dependent trial.

GUIDED TRY

A bag contains 13 green counters, 7 yellow counters and some purple counters, 36 altogether. Find $P(\text{purple})$. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

$P(\text{rain}) = 1/2$. Find $P(\text{no rain})$ and name the probability rule used. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Exhaustive and mutually exclusive outcomes

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. Three mutually exclusive outcomes A, B and C are exhaustive. $P(A)=\frac{1}{5}$ and $P(B)=\frac{1}{4}$. Find $P(C)$.

[3]

2. $P(\text{rain})=\frac{3}{8}$. Find $P(\text{no rain})$ and name the probability rule used.

[2]

3. A bag contains 13 green counters, 7 yellow counters and some purple counters, 36 altogether. Find $P(\text{purple})$.

[3]

4. Three mutually exclusive outcomes A, B and C are exhaustive. $P(A)=\frac{1}{2}$ and $P(B)=\frac{1}{4}$. Find $P(C)$.

[3]

5. $P(\text{rain})=\frac{1}{8}$. Find $P(\text{no rain})$ and name the probability rule used.

[2]

6. A bag contains 16 green counters, 10 yellow counters and some purple counters, 42 altogether. Find $P(\text{purple})$.

[3]

7. Three mutually exclusive outcomes A, B and C are exhaustive. $P(A)=\frac{3}{10}$ and $P(B)=\frac{1}{4}$. Find $P(C)$.

[3]

8. $P(\text{rain})=\frac{1}{2}$. Find $P(\text{no rain})$ and name the probability rule used.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Sample size and reliable probability estimates

Understand why unbiased experimental results tend towards theoretical probabilities as sample size increases.

SPECIFICATION FOCUS

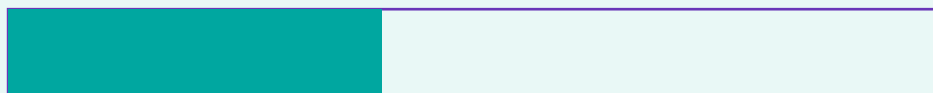
Specification reference Eduqas C300 FP5. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Repeated unbiased trials tend to produce a more stable relative frequency, but size cannot repair a biased method.

KEY VOCABULARY

sample size • bias • reliability • estimate • convergence



observed proportion compared with expected proportion

Why the method works

- The representation accounts for the complete set of possible outcomes.
- Addition combines non-overlapping alternatives; multiplication follows a sequence.
- Complements, branch totals and the 0-to-1 range provide independent checks.

CHECK BEFORE MOVING ON

Answer mentally: Two unbiased experiments estimate the same probability: Experiment A uses 25 trials and Experiment B uses 220 trials. Which estimate is generally more reliable, and why? Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Sample size and reliable probability estimates - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Larger unbiased samples usually reduce the effect of random fluctuation.
- A large biased sample can still be misleading.
- Describe an estimate with appropriate uncertainty rather than as a certainty.

WORKED EXAMPLE 1

Two unbiased experiments estimate the same probability: Experiment A uses 25 trials and Experiment B uses 220 trials. Which estimate is generally more reliable, and why?

SOLUTION

1. For an unbiased experiment, relative frequency tends to settle closer to theoretical probability as the number of trials increases.

ANSWER: Experiment B; a larger sample reduces the effect of random variation

WORKED EXAMPLE 2

An unbiased trial gives 29 successes in 70 attempts. Use this result to estimate successes in the next 340 attempts, and state one limitation.

SOLUTION

1. Estimated probability = $29/70$. Expected successes = $340 \times 29/70 = 986/7$. It is an estimate, not a guarantee.

ANSWER: 986/7; the estimate is affected by random variation

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Sample size and reliable probability estimates - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

scientific trials and surveys use probability models to support decisions while acknowledging uncertainty.

Common misconceptions

- Assuming outcomes are equally likely without evidence.
- Adding probabilities when a sequential route requires multiplication.
- Double-counting overlap or failing to update a dependent trial.

GUIDED TRY

A survey numbered 3 asks only members of a sports club whether the town needs more sports facilities. Explain why increasing this sample from 50 to 500 does not remove the main problem. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

An unbiased trial gives 53 successes in 130 attempts. Use this result to estimate successes in the next 460 attempts, and state one limitation. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Sample size and reliable probability estimates

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

- Two unbiased experiments estimate the same probability: Experiment A uses 25 trials and Experiment B uses 220 trials. Which estimate is generally more reliable, and why? [3]

- An unbiased trial gives 29 successes in 70 attempts. Use this result to estimate successes in the next 340 attempts, and state one limitation. [4]

- A survey numbered 3 asks only members of a sports club whether the town needs more sports facilities. Explain why increasing this sample from 50 to 500 does not remove the main problem. [3]

- Two unbiased experiments estimate the same probability: Experiment A uses 40 trials and Experiment B uses 280 trials. Which estimate is generally more reliable, and why? [3]

- An unbiased trial gives 41 successes in 100 attempts. Use this result to estimate successes in the next 400 attempts, and state one limitation. [4]

- A survey numbered 6 asks only members of a sports club whether the town needs more sports facilities. Explain why increasing this sample from 50 to 500 does not remove the main problem. [3]

- Two unbiased experiments estimate the same probability: Experiment A uses 55 trials and Experiment B uses 340 trials. Which estimate is generally more reliable, and why? [3]

- An unbiased trial gives 53 successes in 130 attempts. Use this result to estimate successes in the next 460 attempts, and state one limitation. [4]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Systematic listing and probability diagrams

Enumerate sets and combinations systematically using appropriate representations.

SPECIFICATION FOCUS

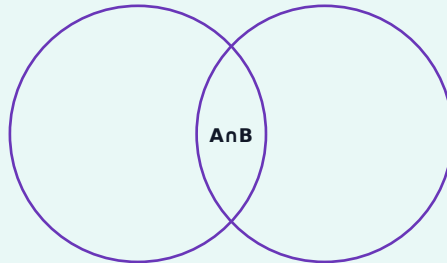
Specification reference Eduqas C300 FP6. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Representations organise an outcome set so combinations and overlaps are counted exactly once.

KEY VOCABULARY

systematic listing • table • Venn diagram • union • intersection



Why the method works

- The representation accounts for the complete set of possible outcomes.
- Addition combines non-overlapping alternatives; multiplication follows a sequence.
- Complements, branch totals and the 0-to-1 range provide independent checks.

CHECK BEFORE MOVING ON

Answer mentally: A student has 3 tops and 4 pairs of trousers. List combinations systematically or use a table to find the number of outfits. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Systematic listing and probability diagrams - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Use an ordered list, table, Venn diagram or tree so every outcome appears once.
- Place an intersection before filling the separate regions of a Venn diagram.
- Count combinations systematically instead of relying on memory.

WORKED EXAMPLE 1

A student has 3 tops and 4 pairs of trousers. List combinations systematically or use a table to find the number of outfits.

SOLUTION

1. Each of 3 tops can be paired with each of 4 trousers: $3 \times 4 = 12$.

ANSWER: 12

WORKED EXAMPLE 2

In a group of 28, 8 are in A only, 9 in B only, 6 in both and 5 in neither. Find the number in A union B and $P(A \text{ union } B)$.

SOLUTION

1. A union B includes A only, B only and both: $8 + 9 + 6 = 23$. Divide by 28.

ANSWER: 23; 23/28

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Systematic listing and probability diagrams - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

classification and product choices use probability models to support decisions while acknowledging uncertainty.

Common misconceptions

- Assuming outcomes are equally likely without evidence.
- Adding probabilities when a sequential route requires multiplication.
- Double-counting overlap or failing to update a dependent trial.

GUIDED TRY

A code contains one of 2 letters followed by one of 6 digits. Draw or describe a tree/list and find the number of possible codes. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

In a group of 52, 14 are in A only, 15 in B only, 12 in both and 11 in neither. Find the number in A union B and $P(A \text{ union } B)$. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Systematic listing and probability diagrams

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. A student has 3 tops and 4 pairs of trousers. List combinations systematically or use a table to find the number of outfits. [3]

2. In a group of 28, 8 are in A only, 9 in B only, 6 in both and 5 in neither. Find the number in A union B and $P(A \text{ union } B)$. [4]

3. A code contains one of 2 letters followed by one of 6 digits. Draw or describe a tree/list and find the number of possible codes. [3]

4. A student has 2 tops and 7 pairs of trousers. List combinations systematically or use a table to find the number of outfits. [3]

5. In a group of 40, 11 are in A only, 12 in B only, 9 in both and 8 in neither. Find the number in A union B and $P(A \text{ union } B)$. [4]

6. A code contains one of 2 letters followed by one of 5 digits. Draw or describe a tree/list and find the number of possible codes. [3]

7. A student has 5 tops and 5 pairs of trousers. List combinations systematically or use a table to find the number of outfits. [3]

8. In a group of 52, 14 are in A only, 15 in B only, 12 in both and 11 in neither. Find the number in A union B and $P(A \text{ union } B)$. [4]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Possibility spaces and theoretical probability

Construct possibility spaces for single and combined equally likely experiments.

SPECIFICATION FOCUS

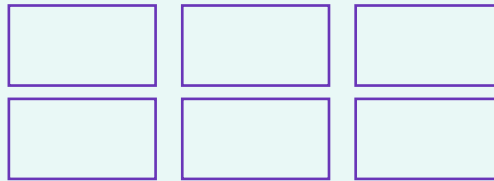
Specification reference Eduqas C300 FP7. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

A possibility space makes the full product of two experiments visible and supports fair counting.

KEY VOCABULARY

possibility space • ordered pair • grid • equally likely • favourable



Why the method works

- The representation accounts for the complete set of possible outcomes.
- Addition combines non-overlapping alternatives; multiplication follows a sequence.
- Complements, branch totals and the 0-to-1 range provide independent checks.

CHECK BEFORE MOVING ON

Answer mentally: Two fair 5-sided dice numbered 1 to 5 are rolled. Construct a possibility space and find $P(\text{total}=6)$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Possibility spaces and theoretical probability - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- A possibility space displays combined outcomes as ordered pairs or grid cells.
- Count equally likely cells, not merely different totals.
- Check the grid dimensions match the numbers of outcomes in both experiments.

WORKED EXAMPLE 1

Two fair 5-sided dice numbered 1 to 5 are rolled. Construct a possibility space and find $P(\text{total}=6)$.

SOLUTION

1. There are 25 equally likely ordered pairs. 5 have total 6, so $P=5/25=1/5$.

ANSWER: 1/5

WORKED EXAMPLE 2

A fair spinner has 5 colours and another has 4 numbers. Use a sample-space grid to find the number of equally likely combined outcomes.

SOLUTION

1. The grid has 5 rows and 4 columns: $5 \times 4=20$ outcomes.

ANSWER: 20

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Possibility spaces and theoretical probability - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

games and simulations use probability models to support decisions while acknowledging uncertainty.

Common misconceptions

- Assuming outcomes are equally likely without evidence.
- Adding probabilities when a sequential route requires multiplication.
- Double-counting overlap or failing to update a dependent trial.

GUIDED TRY

A fair die and a fair coin are used. Find the probability of obtaining Heads and a die score greater than 5. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

A fair spinner has 5 colours and another has 2 numbers. Use a sample-space grid to find the number of equally likely combined outcomes. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Possibility spaces and theoretical probability

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

- Two fair 5-sided dice numbered 1 to 5 are rolled. Construct a possibility space and find $P(\text{total}=6)$. [4]

- A fair spinner has 5 colours and another has 4 numbers. Use a sample-space grid to find the number of equally likely combined outcomes. [2]

- A fair die and a fair coin are used. Find the probability of obtaining Heads and a die score greater than 5. [3]

- Two fair 4-sided dice numbered 1 to 4 are rolled. Construct a possibility space and find $P(\text{total}=5)$. [4]

- A fair spinner has 5 colours and another has 3 numbers. Use a sample-space grid to find the number of equally likely combined outcomes. [2]

- A fair die and a fair coin are used. Find the probability of obtaining Heads and a die score greater than 4. [3]

- Two fair 7-sided dice numbered 1 to 7 are rolled. Construct a possibility space and find $P(\text{total}=8)$. [4]

- A fair spinner has 5 colours and another has 2 numbers. Use a sample-space grid to find the number of equally likely combined outcomes. [2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Independent and dependent combined events

Calculate probabilities of combined independent and dependent events, including with tree diagrams.

SPECIFICATION FOCUS

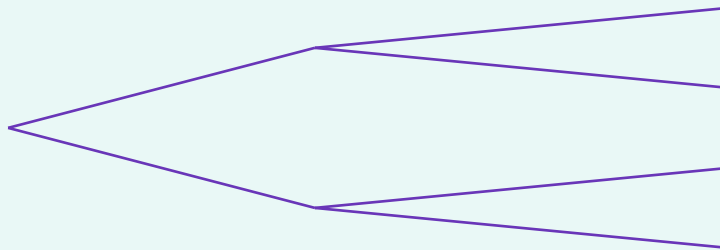
Specification reference Eduqas C300 FP8. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Tree diagrams model sequences: independence preserves probabilities, while dependence changes later branches.

KEY VOCABULARY

independent • dependent • replacement • branch • path



Why the method works

multiply along a path • add alternative paths

- The representation accounts for the complete set of possible outcomes.
- Addition combines non-overlapping alternatives; multiplication follows a sequence.
- Complements, branch totals and the 0-to-1 range provide independent checks.

CHECK BEFORE MOVING ON

Answer mentally: Independent events A and B have $P(A)=\frac{2}{5}$ and $P(B)=\frac{1}{3}$. Find $P(A \text{ and } B)$ and state the assumption used. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Independent and dependent combined events - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Multiply probabilities along a single route.
- Add probabilities for mutually exclusive alternative routes.
- Without replacement, update both the remaining total and the relevant category count.

WORKED EXAMPLE 1

Independent events A and B have $P(A)=2/5$ and $P(B)=1/3$. Find $P(A \text{ and } B)$ and state the assumption used.

SOLUTION

1. For independent events, multiply: $2/5 \times 1/3 = 2/15$.

ANSWER: 2/15; independence

WORKED EXAMPLE 2

A bag contains 5 red and 7 blue counters. Two counters are taken without replacement. Find $P(\text{both red})$ and explain why the second probability changes.

SOLUTION

1. $P(\text{both red}) = 5/12 \times 4/11 = 5/33$. After one red is removed, both the red count and total decrease by 1.

ANSWER: 5/33

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Independent and dependent combined events - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

sampling and staged decisions use probability models to support decisions while acknowledging uncertainty.

Common misconceptions

- Assuming outcomes are equally likely without evidence.
- Adding probabilities when a sequential route requires multiplication.
- Double-counting overlap or failing to update a dependent trial.

GUIDED TRY

An independent event has probability $\frac{2}{3}$ on each of two trials. Find the probability that it occurs at least once. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

A bag contains 11 red and 13 blue counters. Two counters are taken without replacement. Find $P(\text{both red})$ and explain why the second probability changes. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Independent and dependent combined events

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. Independent events A and B have $P(A)=2/5$ and $P(B)=1/3$. Find $P(A \text{ and } B)$ and state the assumption used. [3]

2. A bag contains 5 red and 7 blue counters. Two counters are taken without replacement. Find $P(\text{both red})$ and explain why the second probability changes. [4]

3. An independent event has probability $2/3$ on each of two trials. Find the probability that it occurs at least once. [4]

4. Independent events A and B have $P(A)=2/5$ and $P(B)=1/6$. Find $P(A \text{ and } B)$ and state the assumption used. [3]

5. A bag contains 8 red and 10 blue counters. Two counters are taken without replacement. Find $P(\text{both red})$ and explain why the second probability changes. [4]

6. An independent event has probability $1/2$ on each of two trials. Find the probability that it occurs at least once. [4]

7. Independent events A and B have $P(A)=2/5$ and $P(B)=2/3$. Find $P(A \text{ and } B)$ and state the assumption used. [3]

8. A bag contains 11 red and 13 blue counters. Two counters are taken without replacement. Find $P(\text{both red})$ and explain why the second probability changes. [4]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Experimental frequency and frequency trees

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. A spinner is tested 50 times and lands on blue 12 times. Find the experimental probability...

ANSWER: 6/25

Method cue: Relative frequency = blue outcomes / total trials = $12/50 = 6/25$. Check sign, size, accuracy and units.

2. In 70 trials, red occurs 20 times and blue occurs 24 times. Complete the frequency total...

ANSWER: 26; 13/35

Method cue: Other outcomes = $70 - 20 - 24 = 26$. Relative frequency = $26/70 = 13/35$. Check sign, size, accuracy and units.

3. A frequency tree starts with 85 learners. 45 pass test 1 and 28 pass both tests. How many...

ANSWER: 17

Method cue: The 45 who pass test 1 split into pass and not-pass on test 2. Therefore $45 - 28 = 17$. Check sign, size, accuracy and units.

4. A spinner is tested 80 times and lands on blue 18 times. Find the experimental probability...

ANSWER: 9/40

Method cue: Relative frequency = blue outcomes / total trials = $18/80 = 9/40$. Check sign, size, accuracy and units.

5. In 85 trials, red occurs 23 times and blue occurs 27 times. Complete the frequency total...

ANSWER: 35; 7/17

Method cue: Other outcomes = $85 - 23 - 27 = 35$. Relative frequency = $35/85 = 7/17$. Check sign, size, accuracy and units.

6. A frequency tree starts with 100 learners. 48 pass test 1 and 31 pass both tests. How many...

ANSWER: 17

Method cue: The 48 who pass test 1 split into pass and not-pass on test 2. Therefore $48 - 31 = 17$. Check sign, size, accuracy and units.

7. A spinner is tested 110 times and lands on blue 24 times. Find the experimental probability...

ANSWER: 12/55

Method cue: Relative frequency = blue outcomes / total trials = $24/110 = 12/55$. Check sign, size, accuracy and units.

8. In 100 trials, red occurs 26 times and blue occurs 30 times. Complete the frequency total...

ANSWER: 44; 11/25

Method cue: Other outcomes = $100 - 26 - 30 = 44$. Relative frequency = $44/100 = 11/25$. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Randomness, fairness and expected outcomes

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. A bag contains 3 red and 4 blue counters. A counter is replaced after every draw. In 60 ...

ANSWER: 180/7

Method cue: $P(\text{red}) = 3/7$. Expected frequency $= 60 \times 3/7 = 180/7$. Check sign, size, accuracy and units.

2. A spinner has 7 equal sectors labelled 1, 2, 3, 4, 5, 6, 7. Explain why it is fair for s...

ANSWER: Equal sectors make outcomes equally likely; 1/7

Method cue: A fair spinner gives each of its 7 equal sectors probability $1/7$. Check sign, size, accuracy and units.

3. A standard fair die is rolled 60 times and produces 19 sixes. Does this result prove tha...

ANSWER: No; random variation is expected and one experiment is insufficient evidence

Method cue: The theoretical expected number is $60 \times 1/6 = 10$, but experimental results vary. Further, preferably larger, trials are needed. Check sign, size, accuracy and units.

4. A bag contains 6 red and 7 blue counters. A counter is replaced after every draw. In 90 ...

ANSWER: 540/13

Method cue: $P(\text{red}) = 6/13$. Expected frequency $= 90 \times 6/13 = 540/13$. Check sign, size, accuracy and units.

5. A spinner has 10 equal sectors labelled 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. Explain why it is...

ANSWER: Equal sectors make outcomes equally likely; 1/10

Method cue: A fair spinner gives each of its 10 equal sectors probability $1/10$. Check sign, size, accuracy and units.

6. A standard fair die is rolled 60 times and produces 22 sixes. Does this result prove tha...

ANSWER: No; random variation is expected and one experiment is insufficient evidence

Method cue: The theoretical expected number is $60 \times 1/6 = 10$, but experimental results vary. Further, preferably larger, trials are needed. Check sign, size, accuracy and units.

7. A bag contains 9 red and 10 blue counters. A counter is replaced after every draw. In 12...

ANSWER: 1080/19

Method cue: $P(\text{red}) = 9/19$. Expected frequency $= 120 \times 9/19 = 1080/19$. Check sign, size, accuracy and units.

8. A spinner has 13 equal sectors labelled 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13. Expla...

ANSWER: Equal sectors make outcomes equally likely; 1/13

Method cue: A fair spinner gives each of its 13 equal sectors probability $1/13$. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Relative frequency and the probability scale

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. An event occurs 14 times in 44 trials. Estimate its probability and describe it as impos...

ANSWER: 7/22; unlikely

Method cue: Estimated probability = $14/44 = 7/22$. Compare this value with 0, $1/2$ and 1. Check sign, size, accuracy and units.

2. Place the probability $3/10$ on a 0-to-1 scale and state whether its complement is more or...

ANSWER: At 0.3; complement $7/10$, more likely

Method cue: The complement is $1 - 3/10 = 7/10$. Compare the two probabilities. Check sign, size, accuracy and units.

3. The theoretical probability of an outcome is $1/5$. In 160 trials it occurs 33 times. Find...

ANSWER: 33/160; it is above the theoretical value

Method cue: Relative frequency = $33/160 = 33/160$. The theoretical value is $1/5$. Check sign, size, accuracy and units.

4. An event occurs 20 times in 56 trials. Estimate its probability and describe it as impos...

ANSWER: 5/14; unlikely

Method cue: Estimated probability = $20/56 = 5/14$. Compare this value with 0, $1/2$ and 1. Check sign, size, accuracy and units.

5. Place the probability $3/5$ on a 0-to-1 scale and state whether its complement is more or ...

ANSWER: At 0.6; complement $2/5$, less likely

Method cue: The complement is $1 - 3/5 = 2/5$. Compare the two probabilities. Check sign, size, accuracy and units.

6. The theoretical probability of an outcome is $1/5$. In 220 trials it occurs 43 times. Find...

ANSWER: 43/220; it is below the theoretical value

Method cue: Relative frequency = $43/220 = 43/220$. The theoretical value is $1/5$. Check sign, size, accuracy and units.

7. An event occurs 26 times in 68 trials. Estimate its probability and describe it as impos...

ANSWER: 13/34; unlikely

Method cue: Estimated probability = $26/68 = 13/34$. Compare this value with 0, $1/2$ and 1. Check sign, size, accuracy and units.

8. Place the probability $1/10$ on a 0-to-1 scale and state whether its complement is more or...

ANSWER: At 0.1; complement $9/10$, more likely

Method cue: The complement is $1 - 1/10 = 9/10$. Compare the two probabilities. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Exhaustive and mutually exclusive outcomes

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Three mutually exclusive outcomes A, B and C are exhaustive. $P(A)=1/5$ and $P(B)=1/4$. Find...

ANSWER: $11/20$

Method cue: Exhaustive mutually exclusive probabilities total 1, so $P(C)=1-1/5-1/4=11/20$. Check sign, size, accuracy and units.

2. $P(\text{rain})=3/8$. Find $P(\text{no rain})$ and name the probability rule used.

ANSWER: $5/8$; complementary outcomes sum to 1

Method cue: Rain and no rain are complementary, so $P(\text{no rain})=1-3/8=5/8$. Check sign, size, accuracy and units.

3. A bag contains 13 green counters, 7 yellow counters and some purple counters, 36 altogether...

ANSWER: $4/9$

Method cue: Purple counters $=36-13-7=16$. Divide by 36. Check sign, size, accuracy and units.

4. Three mutually exclusive outcomes A, B and C are exhaustive. $P(A)=1/2$ and $P(B)=1/4$. Find...

ANSWER: $1/4$

Method cue: Exhaustive mutually exclusive probabilities total 1, so $P(C)=1-1/2-1/4=1/4$. Check sign, size, accuracy and units.

5. $P(\text{rain})=1/8$. Find $P(\text{no rain})$ and name the probability rule used.

ANSWER: $7/8$; complementary outcomes sum to 1

Method cue: Rain and no rain are complementary, so $P(\text{no rain})=1-1/8=7/8$. Check sign, size, accuracy and units.

6. A bag contains 16 green counters, 10 yellow counters and some purple counters, 42 altogether...

ANSWER: $8/21$

Method cue: Purple counters $=42-16-10=16$. Divide by 42. Check sign, size, accuracy and units.

7. Three mutually exclusive outcomes A, B and C are exhaustive. $P(A)=3/10$ and $P(B)=1/4$. Find...

ANSWER: $9/20$

Method cue: Exhaustive mutually exclusive probabilities total 1, so $P(C)=1-3/10-1/4=9/20$. Check sign, size, accuracy and units.

8. $P(\text{rain})=1/2$. Find $P(\text{no rain})$ and name the probability rule used.

ANSWER: $1/2$; complementary outcomes sum to 1

Method cue: Rain and no rain are complementary, so $P(\text{no rain})=1-1/2=1/2$. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Sample size and reliable probability estimates

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Two unbiased experiments estimate the same probability: Experiment A uses 25 trials and ...

ANSWER: Experiment B; a larger sample reduces the effect of random variation

Method cue: For an unbiased experiment, relative frequency tends to settle closer to theoretical probability as the number of trials increases. Check sign, size, accuracy and units.

2. An unbiased trial gives 29 successes in 70 attempts. Use this result to estimate success...

ANSWER: 986/7; the estimate is affected by random variation

Method cue: Estimated probability=29/70. Expected successes=340 x 29/70=986/7. It is an estimate, not a guarantee. Check sign, size, accuracy and units.

3. A survey numbered 3 asks only members of a sports club whether the town needs more sport...

ANSWER: The sample remains biased and is not representative of the whole town

Method cue: A large biased sample can still give a systematically misleading estimate. Sampling method matters as well as sample size. Check sign, size, accuracy and units.

4. Two unbiased experiments estimate the same probability: Experiment A uses 40 trials and ...

ANSWER: Experiment B; a larger sample reduces the effect of random variation

Method cue: For an unbiased experiment, relative frequency tends to settle closer to theoretical probability as the number of trials increases. Check sign, size, accuracy and units.

5. An unbiased trial gives 41 successes in 100 attempts. Use this result to estimate success...

ANSWER: 164; the estimate is affected by random variation

Method cue: Estimated probability=41/100. Expected successes=400 x 41/100=164. It is an estimate, not a guarantee. Check sign, size, accuracy and units.

6. A survey numbered 6 asks only members of a sports club whether the town needs more sport...

ANSWER: The sample remains biased and is not representative of the whole town

Method cue: A large biased sample can still give a systematically misleading estimate. Sampling method matters as well as sample size. Check sign, size, accuracy and units.

7. Two unbiased experiments estimate the same probability: Experiment A uses 55 trials and ...

ANSWER: Experiment B; a larger sample reduces the effect of random variation

Method cue: For an unbiased experiment, relative frequency tends to settle closer to theoretical probability as the number of trials increases. Check sign, size, accuracy and units.

8. An unbiased trial gives 53 successes in 130 attempts. Use this result to estimate success...

ANSWER: 2438/13; the estimate is affected by random variation

Method cue: Estimated probability=53/130. Expected successes=460 x 53/130=2438/13. It is an estimate, not a guarantee. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Systematic listing and probability diagrams

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. A student has 3 tops and 4 pairs of trousers. List combinations systematically or use a ...

ANSWER: 12

Method cue: Each of 3 tops can be paired with each of 4 trousers: $3 \times 4 = 12$. Check sign, size, accuracy and units.

2. In a group of 28, 8 are in A only, 9 in B only, 6 in both and 5 in neither. Find the num...

ANSWER: 23; 23/28

Method cue: A union B includes A only, B only and both: $8 + 9 + 6 = 23$. Divide by 28. Check sign, size, accuracy and units.

3. A code contains one of 2 letters followed by one of 6 digits. Draw or describe a tree/li...

ANSWER: 12

Method cue: There are 6 branches for each of 2 letters, giving $2 \times 6 = 12$ codes. Check sign, size, accuracy and units.

4. A student has 2 tops and 7 pairs of trousers. List combinations systematically or use a ...

ANSWER: 14

Method cue: Each of 2 tops can be paired with each of 7 trousers: $2 \times 7 = 14$. Check sign, size, accuracy and units.

5. In a group of 40, 11 are in A only, 12 in B only, 9 in both and 8 in neither. Find the n...

ANSWER: 32; 4/5

Method cue: A union B includes A only, B only and both: $11 + 12 + 9 = 32$. Divide by 40. Check sign, size, accuracy and units.

6. A code contains one of 2 letters followed by one of 5 digits. Draw or describe a tree/li...

ANSWER: 10

Method cue: There are 5 branches for each of 2 letters, giving $2 \times 5 = 10$ codes. Check sign, size, accuracy and units.

7. A student has 5 tops and 5 pairs of trousers. List combinations systematically or use a ...

ANSWER: 25

Method cue: Each of 5 tops can be paired with each of 5 trousers: $5 \times 5 = 25$. Check sign, size, accuracy and units.

8. In a group of 52, 14 are in A only, 15 in B only, 12 in both and 11 in neither. Find the...

ANSWER: 41; 41/52

Method cue: A union B includes A only, B only and both: $14 + 15 + 12 = 41$. Divide by 52. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Possibility spaces and theoretical probability

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Two fair 5-sided dice numbered 1 to 5 are rolled. Construct a possibility space and find...

ANSWER: 1/5

Method cue: There are 25 equally likely ordered pairs. 5 have total 6, so $P=5/25=1/5$. Check sign, size, accuracy and units.

2. A fair spinner has 5 colours and another has 4 numbers. Use a sample-space grid to find ...

ANSWER: 20

Method cue: The grid has 5 rows and 4 columns: $5 \times 4=20$ outcomes. Check sign, size, accuracy and units.

3. A fair die and a fair coin are used. Find the probability of obtaining Heads and a die s...

ANSWER: 1/12

Method cue: The equally likely possibility space has 12 outcomes. Heads with scores 6 to 6 gives 1 favourable outcomes, so $P=1/12$. Check sign, size, accuracy and units.

4. Two fair 4-sided dice numbered 1 to 4 are rolled. Construct a possibility space and find...

ANSWER: 1/4

Method cue: There are 16 equally likely ordered pairs. 4 have total 5, so $P=4/16=1/4$. Check sign, size, accuracy and units.

5. A fair spinner has 5 colours and another has 3 numbers. Use a sample-space grid to find ...

ANSWER: 15

Method cue: The grid has 5 rows and 3 columns: $5 \times 3=15$ outcomes. Check sign, size, accuracy and units.

6. A fair die and a fair coin are used. Find the probability of obtaining Heads and a die s...

ANSWER: 1/6

Method cue: The equally likely possibility space has 12 outcomes. Heads with scores 5 to 6 gives 2 favourable outcomes, so $P=1/6$. Check sign, size, accuracy and units.

7. Two fair 7-sided dice numbered 1 to 7 are rolled. Construct a possibility space and find...

ANSWER: 1/7

Method cue: There are 49 equally likely ordered pairs. 7 have total 8, so $P=7/49=1/7$. Check sign, size, accuracy and units.

8. A fair spinner has 5 colours and another has 2 numbers. Use a sample-space grid to find ...

ANSWER: 10

Method cue: The grid has 5 rows and 2 columns: $5 \times 2=10$ outcomes. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Independent and dependent combined events

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Independent events A and B have $P(A)=2/5$ and $P(B)=1/3$. Find $P(A \text{ and } B)$ and state the ass...

ANSWER: $2/15$; independence

Method cue: For independent events, multiply: $2/5 \times 1/3 = 2/15$. Check sign, size, accuracy and units.

2. A bag contains 5 red and 7 blue counters. Two counters are taken without replacement. Fi...

ANSWER: $5/33$

Method cue: $P(\text{both red}) = 5/12 \times 4/11 = 5/33$. After one red is removed, both the red count and total decrease by 1. Check sign, size, accuracy and units.

3. An independent event has probability $2/3$ on each of two trials. Find the probability tha...

ANSWER: $8/9$

Method cue: Use the complement: $P(\text{at least once}) = 1 - P(\text{neither}) = 1 - (1/3)^2 = 8/9$. Check sign, size, accuracy and units.

4. Independent events A and B have $P(A)=2/5$ and $P(B)=1/6$. Find $P(A \text{ and } B)$ and state the ass...

ANSWER: $1/15$; independence

Method cue: For independent events, multiply: $2/5 \times 1/6 = 1/15$. Check sign, size, accuracy and units.

5. A bag contains 8 red and 10 blue counters. Two counters are taken without replacement. F...

ANSWER: $28/153$

Method cue: $P(\text{both red}) = 8/18 \times 7/17 = 28/153$. After one red is removed, both the red count and total decrease by 1. Check sign, size, accuracy and units.

6. An independent event has probability $1/2$ on each of two trials. Find the probability tha...

ANSWER: $3/4$

Method cue: Use the complement: $P(\text{at least once}) = 1 - P(\text{neither}) = 1 - (1/2)^2 = 3/4$. Check sign, size, accuracy and units.

7. Independent events A and B have $P(A)=2/5$ and $P(B)=2/3$. Find $P(A \text{ and } B)$ and state the ass...

ANSWER: $4/15$; independence

Method cue: For independent events, multiply: $2/5 \times 2/3 = 4/15$. Check sign, size, accuracy and units.

8. A bag contains 11 red and 13 blue counters. Two counters are taken without replacement. ...

ANSWER: $55/276$

Method cue: $P(\text{both red}) = 11/24 \times 10/23 = 55/276$. After one red is removed, both the red count and total decrease by 1. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Independent authorship and release check

Eduqas Foundation Mathematics • Unit 5 Probability

ORIGINAL-CONTENT STATEMENT

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Release checklist

- 8 publisher-organised chapters mapped to Eduqas C300 references FP1-FP8.
- Every chapter begins on a new page and contains conceptual explanation.
- Original vector diagrams and two worked examples appear in every chapter.
- Applications, misconceptions, guided reasoning and independent practice are included.
- Answers are collected at the end with method cues.
- Copyright, trademark and non-endorsement wording included.

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