

Probability

Quick revision notes [Open it online](#)

Name: _____

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At a glance

Probability scale, single events, relative and expected frequency, sample spaces, tree diagrams and conditional probability.

1. Single events
2. Relative and expected frequency
3. Sample spaces and combined events
4. Tree diagrams
5. Conditional probability

1. Single events

☐ I revised this

- Probability is from 0 (impossible) to 1 (certain). Write it as a fraction, decimal or percentage.
- $P(\text{event}) = \text{number of ways it happens} \div \text{total number of equally likely outcomes}$.
- $P(\text{not } A) = 1 - P(A)$. The probabilities of all possible outcomes add to 1.

Formulas

$$P(A) = \text{favourable} \div \text{total}$$

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

Worked example

The only outcomes A, B and C have probabilities 0.2, 0.45 and x. Find x.

$$1. \ 0.2 + 0.45 + x = 1.$$

$$x = 0.35$$

2. Relative and expected frequency

☐ I revised this

- Relative frequency = number of times it happened $\div$ number of trials. It estimates the probability; more trials = better estimate.
- Expected frequency = probability $\times$ number of trials.

Worked example

A spinner landed on 6 in 45 of 300 spins. How many 6s would you expect in 1000 spins?

$$1. \ \text{Relative frequency} = 45/300 = 0.15.$$

$$2. \ 0.15 \times 1000.$$

$$150$$

3. Sample spaces and combined events

☐ I revised this

- A sample space diagram (grid) lists every outcome of two events — useful for two dice or two spinners.
- **AND** (independent events): multiply. **OR** (events that can't both happen): add.
- 'At least one' = $1 - P(\text{none})$.

Formulas

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

independent

$$P(A \text{ or } B) = P(A) + P(B)$$

mutually exclusive

$$P(\text{at least one}) = 1 - P(\text{none})$$

Worked example

Two fair dice are thrown. Find the probability that the total is 7.

1. 36 outcomes in the grid.
2. Totals of 7: (1,6), (2,5), (3,4), (4,3), (5,2), (6,1) — 6 outcomes.

$$6/36 = 1/6$$

4. Tree diagrams

☐ I revised this

- Each set of branches adds to 1.
- Multiply **along** a path; add the paths you want.
- **With replacement**: the second-stage probabilities are the same as the first.
- **Without replacement**: one fewer item in total, and one fewer of the colour already taken.

How to do it

1. Draw the branches with probabilities.
2. Multiply along each wanted path.
3. Add the results of all wanted paths.

Worked example

A bag has 4 red and 6 blue sweets. Two are eaten without replacement. Find $P(\text{one of each colour})$.

1. $P(R \text{ then } B) = 4/10 \times 6/9 = 24/90$.
2. $P(B \text{ then } R) = 6/10 \times 4/9 = 24/90$.
3. Add: $48/90$.

$$8/15$$

5. Conditional probability

☐ I revised this

- 'Given that' narrows the total to the group you are told about.
- From a table or Venn diagram: count only within the given group.
- From a tree: the second branches are already conditional on the first.

Formulas

$$P(A \text{ given } B) = P(A \text{ and } B) \div P(B)$$

Worked example

12 of 20 girls and 6 of 10 boys wear glasses. A student who wears glasses is chosen. Find the probability it is a boy.

1. 18 students wear glasses.
2. 6 of them are boys.

$$6/18 = 1/3$$

Common mistakes

Don't write	Write instead
✗ Adding along the branches	✓ Multiply along a path; add the results
✗ Same denominator on both stages without replacement	✓ 4/10 then 3/9 (or 6/9)
✗ A probability bigger than 1	✓ Probabilities are between 0 and 1
✗ Writing a probability as '3 out of 5' or 3 : 5	✓ Write 3/5, 0.6 or 60%
✗ Forgetting one of the two orders for 'one of each'	✓ Red-then-blue AND blue-then-red

In the exam

- Draw the tree or grid even when not asked.
- Fractions don't need simplifying unless asked — but keep them exact.
- Check: all end probabilities of a tree add to 1.

My notes

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