

Exercise walk-through

E8.2

Relative and expected frequencies

IGCSE Mathematics

You must be able to

- calculate a relative frequency from a set of trials
- calculate an expected frequency as $\text{probability} \times \text{number of trials}$
- use a relative frequency to estimate a probability, and comment on reliability

1

The method

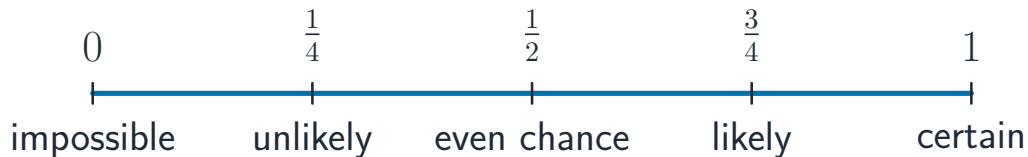
Method — Relative frequency looks back; expected frequency looks forward

- **Relative frequency** = $\frac{\text{number of times it happened}}{\text{number of trials}}$. It is what the experiment GAVE you.
- **Expected frequency** = probability $\times$ number of trials. It is what theory PREDICTS.
- **Estimating a probability:** use the relative frequency, and say that more trials make the estimate more reliable.
- **Commenting on fairness:** compare the relative frequency with the theoretical probability, and say whether the difference is big enough to matter given the number of trials.

Answer shapes (marked by **method marks** — M1 for a correct method, A1 for the correct answer): the multiplication or the fraction is the method mark, and the comment is a separate mark that a number alone cannot earn.

Method — Relative frequency looks back; expected frequency looks forward

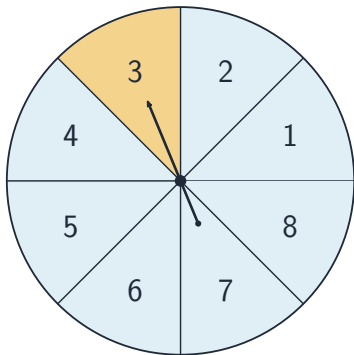
Answer shapes (marked by method marks — M1 for a correct method, A1 for the correct answer): the...



The probability scale from impossible to certain

Method — Relative frequency looks back; expected frequency looks forward

Answer shapes (marked by method marks — M1 for a correct method, A1 for the correct answer): the...



Eight identical sectors, so every number is **equally likely**.

$$P(3) = \frac{\text{favourable outcomes}}{\text{total outcomes}} = \frac{1}{8}$$

A spinner divided into equal sectors

2

Practice

Practice 2.1 ■ 2 marks

A coin is flipped 80 times and lands on heads 34 times. Find the relative frequency of heads.

Solution 2.1

Method: Relative frequency looks back; expected frequency looks forward — p.4

Worked steps

$$\blacksquare \frac{34}{80} \quad \text{M1}$$

$$= 0.425$$

A1

Practice 2.2 ■ 2 marks

A fair six-sided dice is rolled 300 times. Find the expected number of sixes.

Solution 2.2

Method: Relative frequency looks back; expected frequency looks forward — p.4

Worked steps

$$\blacksquare \frac{1}{6} \times 300 \quad \text{M1}$$

$$= 50$$

A1

Practice 2.3 ■ 2 marks

The probability that a component is faulty is 0.03. In a batch of 2000, find the expected number of faulty components.

Solution 2.3

Method: Relative frequency looks back; expected frequency looks forward — p.4

Worked steps

$$\blacksquare 0.03 \times 2000 \quad \text{M1}$$

$$= 60$$

A1

3

Exam-style

Exam-style 3.1 ■ 6 marks

A spinner has five equal sectors numbered 1 to 5. It is spun 400 times.

Exam-style 3.1 (a) ■ 2 marks

Find the expected number of times it lands on 3.

Solution 3.1 (a)

Method: Relative frequency looks back; expected frequency looks forward — p.4

Worked steps

■ each sector has probability $\frac{1}{5}$, so $\frac{1}{5} \times 400$ **M1**

= 80

A1

Exam-style 3.1 (b) ■ 2 marks

It actually lands on 3 on 68 occasions. Find the relative frequency of landing on 3.

Solution 3.1 (b)

Worked steps

$$\blacksquare \frac{68}{400} \quad \text{M1}$$

$$= 0.17$$

A1

Exam-style 3.1 (c) ■ 2 marks

Comment on whether the spinner appears to be fair.

Solution 3.1 (c)

Worked steps

- 0.17 is below the theoretical 0.2, so it landed on 3 less often than expected
B1
- but 400 spins is not a large number of trials and this difference could easily be chance; more spins would give a more reliable answer, so there is not enough evidence to call it biased B1

Exam-style 3.2 ■ 4 marks

In a trial, 215 of 250 seeds germinate.

Exam-style 3.2 (a) ■ 2 marks

Find the relative frequency of germination.

Solution 3.2 (a)

Method: Relative frequency looks back; expected frequency looks forward — p.4

Worked steps

$$\blacksquare \frac{215}{250} \quad \text{M1}$$

$$= 0.86$$

A1

Exam-style 3.2 (b) ■ 2 marks

Estimate the number that would germinate from a batch of 4000 seeds.

Solution 3.2 (b)

Worked steps

$$\blacksquare 0.86 \times 4000 \quad \text{M1}$$

$$= 3440$$

A1