

E8.2 Relative and expected frequencies

Name: _____ Class: _____ Date: _____ **Total: 16 marks**

KEY WORDS relative frequency 相对频率 • expected frequency 期望频数 • trial 试验 • bias 偏差
• reliable 可靠的

Objective

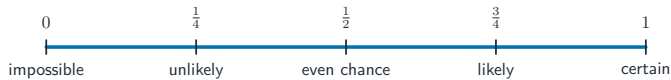
Build the skills to answer Extended exam questions on **relative and expected frequencies** 相对频率与期望频数 — calculating a **relative frequency** 相对频率 from experimental results, calculating an **expected frequency** 期望频数 from a probability, and commenting on whether a result suggests **bias** 偏差.

You must be able to:

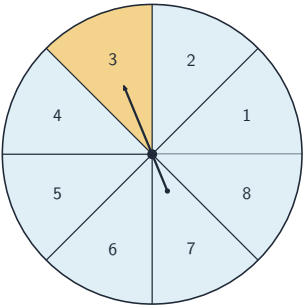
- calculate a relative frequency from a set of trials
- calculate an expected frequency as probability × number of trials
- use a relative frequency to estimate a probability, and comment on reliability

1 Worked examples

■ **Relative frequency looks back; expected frequency looks forward**



Every probability lies between 0 and 1 — so does every relative frequency



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

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

On a fair spinner every sector is equally likely

- **Relative frequency** = $\frac{\text{number of times it happened}}{\text{number of trials}}$. It is what the experiment GAVE you.
- **Expected frequency** = probability × number of trials. It is what theory PRE-DICTS.
- **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.

2 Practice

2.1 A coin is flipped 80 times and lands on heads 34 times. Find the relative frequency of heads. [2]

2.2 A fair six-sided dice is rolled 300 times. Find the expected number of sixes. [2]

2.3 The probability that a component is faulty is 0.03. In a batch of 2000, find the expected number of faulty components. [2]

3 Exam-style questions

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

(a) Find the expected number of times it lands on 3. [2]

(b) It actually lands on 3 on 68 occasions. Find the relative frequency of landing on 3. [2]

(c) Comment on whether the spinner appears to be fair. [2]

3.2 In a trial, 215 of 250 seeds germinate.

(a) Find the relative frequency of germination. [2]

(b) Estimate the number that would germinate from a batch of 4000 seeds. [2]

Solutions

Marking: **M1** a correct method, **A1** the correct answer.

Each answer shows the steps, then the **result**.

2.1

$$\begin{aligned} &\bullet \frac{34}{80} \\ &= \mathbf{0.425} \end{aligned}$$

2.2

$$\begin{aligned} &\bullet \frac{1}{6} \times 300 \\ &= \mathbf{50} \end{aligned}$$

2.3

$$\begin{aligned} &\bullet 0.03 \times 2000 \\ &= \mathbf{60} \end{aligned}$$

3.1

(a)

$$\begin{aligned} &\bullet \text{ each sector has probability } \frac{1}{5}, \text{ so } \frac{1}{5} \times 400 \\ &= \mathbf{80} \end{aligned}$$

(b)

$$\begin{aligned} &\bullet \frac{68}{400} \\ &= \mathbf{0.17} \end{aligned}$$

(c)

- 0.17 is below the theoretical 0.2, so it landed on 3 less often than expected
- 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

3.2

(a)

$$\begin{aligned} &\bullet \frac{215}{250} \\ &= \mathbf{0.86} \end{aligned}$$

(b)

$$\begin{aligned} &\bullet 0.86 \times 4000 \\ &= \mathbf{3440} \end{aligned}$$