

Exercise walk-through

Introduction to the Binomial Distribution ■ 4.10

eXercise

You must be able to

- recognise a **binomial** 二项 setting: n independent trials, each a success or failure, with fixed p
- calculate $P(X = x) = \binom{n}{x} p^x (1 - p)^{n-x}$

Method — The binomial setting

A binomial random variable X counts the number of **successes** in n trials that are:

- **fixed** in number (n),
- **two-outcome** (success/failure),
- **independent**, with
- a **constant** probability of success p .

Method — The binomial formula

$$P(X = x) = \binom{n}{x} p^x (1 - p)^{n-x}.$$

For $n = 3$, $p = 0.5$, $x = 2$: $\binom{3}{2} (0.5)^2 (0.5)^1 = 3 \times 0.125 = 0.375$.

Practice 2.1 ■ 2 marks

State the four conditions of a binomial setting.

Solution 2.1

Method: The binomial setting

Worked steps

fixed number of trials; two outcomes; independent trials; constant p **B1** **B1** *for any two; for all four.*

Practice 2.2 ■ 1 mark

Write the binomial probability formula.

Solution 2.2

Worked steps

$$P(X = x) = \binom{n}{x} p^x (1 - p)^{n-x} \text{ B1.}$$

Practice 2.3 ■ 2 marks

For $n = 4$, $p = 0.5$, find $P(X = 4)$.

Solution 2.3

Worked steps

$$P(X = 4) = \binom{4}{4} (0.5)^4 = (0.5)^4 = 0.0625 \quad \text{M1} \quad \text{A1}.$$

Exam-style 3.1 ■ 1 mark

A binomial random variable counts the number of

- A** trials
- B** successes in n trials
- C** failures only
- D** outcomes

Solution 3.1

Method: The binomial setting

- A trials
- B successes in n trials 
- C failures only
- D outcomes

Worked steps

B.

Exam-style 3.2 ■ 1 mark

In a binomial setting, the probability of success p is

- A** changing each trial
- B** constant across trials
- C** zero
- D** exactly 1

Solution 3.2

Method: The binomial setting

A changing each trial

B constant across trials 

C zero

D exactly 1

Worked steps

B.

Exam-style 3.3 ■ 1 mark

A fair coin is flipped 3 times; X = number of heads.

- (a) State n and p .
- (b) Find $P(X = 0)$.
- (c) Name the distribution.

Solution 3.3

Worked steps

(a) $n = 3$, $p = 0.5$ **B1**. (b) $P(X = 0) = (0.5)^3 = 0.125$ **M1** **A1**. (c) binomial **B1**.