Random variables and probability tables

6 questions | 13 marks

Equivalent correct methods earn the corresponding marks.

1. Let X count the number of goals in a match. Explain why X is discrete. [1 mark]

Goals are counted in whole numbers.

The possible values can be listed.

Answer: Its possible values are 0, 1, 2, … .

2. X takes values 0, 2 and 5 with probabilities 0.2, 0.5 and p. Find p. [2 marks]

Add the known probabilities: $0.2 + 0.5 = 0.7$.

Use total probability 1: $p = 1 - 0.7 = 0.3$.

Answer: $p = 0.3$.

3. For values -1, 0 and 1, probabilities are $k, 4k, 3k$. Find k and the probability of a positive value. [3 marks]

$8k = 1$, so $k = \frac{1}{8}$.

Only the value 1 is positive, giving probability $3k$.

Answer: $k = \frac{1}{8}$; $P(X > 0) = \frac{3}{8}$.

4. A proposed table uses probabilities 0.4, −0.1 and 0.7. Is it valid? Explain. [2 marks]

The entries do sum to 1.

That is insufficient: every individual probability must be at least zero.

Answer: No. A probability is negative.

5. A bag contains three red and one blue counter. One is selected fairly. Define $X = 1$ for red and $X = 0$ for blue. Give its distribution. [2 marks]

There are four equally likely counters.

Group the three red outcomes at $X = 1$ and the one blue outcome at $X = 0$.

Answer: $P(X = 0) = \frac{1}{4},\ P(X = 1) = \frac{3}{4}$.

6. Two fair independent coin tosses are made. Let Y be the number of tails. Give all values and probabilities. [3 marks]

List HH, HT, TH and TT.

The tail counts are 0, 1, 1 and 2; group equal counts.

Answer: $y = 0, 1, 2$ with probabilities $\frac{1}{4}, \frac{1}{2}, \frac{1}{4}$.