

Exercise walk-through

Conditional Probability ■ 4.5

eXercise

You must be able to

- calculate a **conditional probability** 条件概率, $P(A | B) = \frac{P(A \cap B)}{P(B)}$
- apply the **multiplication rule** 乘法法则, $P(A \cap B) = P(A) \cdot P(B | A)$

Method — Conditional probability

$$P(A \mid B) = \frac{P(A \cap B)}{P(B)}$$

is the probability of A **given** that B has occurred.

Method — Multiplication rule

$$P(A \cap B) = P(A) \cdot P(B \mid A).$$

Method — Example

If $P(A \cap B) = 0.2$ and $P(B) = 0.5$, then $P(A \mid B) = \frac{0.2}{0.5} = 0.4$.

Practice 2.1 ■ 1 mark

Write the formula for $P(A \mid B)$.

Solution 2.1

Worked steps

$$P(A \mid B) = \frac{P(A \cap B)}{P(B)} \quad \text{B1}.$$

Practice 2.2 ■ 2 marks

If $P(A \cap B) = 0.12$ and $P(B) = 0.4$, find $P(A \mid B)$.

Solution 2.2

Worked steps

$$P(A \mid B) = \frac{0.12}{0.4} = 0.3 \quad \text{M1 A1}.$$

Practice 2.3 ■ 1 mark

State the multiplication rule.

Solution 2.3

Method: Multiplication rule

Worked steps

$$P(A \cap B) = P(A) \cdot P(B \mid A) \quad \text{B1}.$$

Exam-style 3.1 ■ 1 mark

$P(A \mid B)$ equals

A $\frac{P(A \cap B)}{P(B)}$

B $P(A) + P(B)$

C $P(A) \cdot P(B)$

D $\frac{P(B)}{P(A)}$

Solution 3.1

A $\frac{P(A \cap B)}{P(B)}$



B $P(A) + P(B)$

C $P(A) \cdot P(B)$

D $\frac{P(B)}{P(A)}$

Worked steps

A.

Exam-style 3.2 ■ 1 mark

The multiplication rule gives $P(A \cap B) =$

A $P(A) + P(B \mid A)$

B $P(A) \cdot P(B \mid A)$

C $\frac{P(A)}{P(B)}$

D $P(A) - P(B)$

Solution 3.2

Method: Multiplication rule

A $P(A) + P(B \mid A)$

B $P(A) \cdot P(B \mid A)$ 

C $\frac{P(A)}{P(B)}$

D $P(A) - P(B)$

Worked steps

B.

Exam-style 3.3 ■ 2 marks

In a class, $P(\text{likes maths and science}) = 0.3$ and $P(\text{science}) = 0.6$.

- (a) Find $P(\text{likes maths} \mid \text{science})$.
- (b) Write the general formula for $P(A \mid B)$.

Solution 3.3

Worked steps

$$(a) \frac{0.3}{0.6} = 0.5 \quad \text{M1} \quad \text{A1}. \quad (b) P(A \mid B) = \frac{P(A \cap B)}{P(B)} \quad \text{B1}.$$