



ANSWER BOOK

Probability and Venn diagrams

Statistics · Year 12–13

6 questions · 20 marks

NAVY EDITION

SECTION A · Warm-up

- A1** Mutually exclusive means the events cannot happen together: $P(A \cap B) = 0$. The addition rule then loses its correction term: $P(A \cup B) = 0.45 + 0.35 = 0.8$. [2]
- A2** Rearranging the addition rule: $P(A \cap B) = 0.55 + 0.4 - 0.75 = 0.2$. Independence test: $P(A) \times P(B) = 0.22$, which does not equal 0.2, so the events are not independent. The conclusion sentence must state the comparison, not just the verdict.

SECTION B · Standard

- B1** The overlap goes in first: 20. Art only is $55 - 20 = 35$; music only is $40 - 20 = 20$; the regions so far hold 75, leaving 25 outside both circles. Filling from the middle outwards is the whole technique: subtract the overlap before anything else. [4]
- B2** Exactly one means art only or music only: $(35 + 20)/100 = 0.55$. Neither is the outside region: $25/100 = 0.25$. 'Exactly one' excludes the overlap, which is precisely what makes it a different question from $P(A \cup B)$. [4]
- B3** Mutually exclusive: they cannot both happen, so the circles do not overlap. [3]
Independent: one happening tells you nothing about the other, so $P(A \cap B) = P(A)P(B)$. Far from being similar, the two are incompatible for events of nonzero probability: exclusivity is the strongest possible dependence, since one occurring forbids the other.

SECTION C · Stretch

- C1** Let $P(B) = x$. Independence gives $P(A \cap B) = 0.5x$, and the addition rule reads $0.8 = 0.5x + x - 0.5x = 0.5 + 0.5x$. So $0.5x = 0.3$ and $P(B) = 0.6$. The check: $0.5 + 0.6 - 0.3 = 0.8$. Independence supplied the missing overlap as an expression, and the rule turned it into an equation. [4]