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Name ..... Class .....

P9: Conditional probability

Reason with conditional probability

20 marks · 25 minutes · Non-calculator

1) In a school, 6 of 40 boys and 4 of 60 girls are left-handed. Explain the difference between $P(\text{boy} \mid \text{left-handed})$ and $P(\text{left-handed} \mid \text{boy})$ and find both.

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[Question 1: 3 marks]

2) Use frequencies to explain why $P(A \mid B) = \dfrac{P(A \cap B)}{P(B)}$

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[Question 2: 2 marks]

3) 1% of people have a disease. A test is positive for 90% of people with the disease and 10% of people without it. Using 1000 people, show that $P(\text{disease} \mid \text{positive}) = \frac{1}{12}$ and explain why it is so low.

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[Question 3: 3 marks]

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4) Kim says that if $P(A \mid B) = P(A)$, then A and B are mutually exclusive. Explain her mistake.

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[Question 4: 2 marks]

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5) In a Venn diagram, 15 people drink tea only, 10 drink both, 20 drink coffee only and 5 drink neither. Show that $P(\text{tea} \mid \text{coffee}) = \frac{1}{3}$

[Question 5: 2 marks]

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6) Explain why the second pick is a conditional probability when sampling without replacement.

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[Question 6: 2 marks]

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7) $P(\text{rain}) = 0.3$. $P(\text{late} \mid \text{rain}) = 0.4$ and $P(\text{late} \mid \text{no rain}) = 0.1$. Show that $P(\text{late}) = 0.19$ and $P(\text{rain} \mid \text{late}) = \frac{12}{19}$

[Question 7: 3 marks]

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8) Explain why $P(A \mid B)$ and $P(B \mid A)$ are usually different.

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[Question 8: 1 marks]

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9) $P(\text{yes} \mid \text{Year 10}) = 0.6$ and $P(\text{yes}) = 0.6$. Are "Year 10" and "yes" independent? Explain.

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[Question 9: 2 marks]

End of paper – 20 marks in total

Answers and brief mark scheme

Q	Answer	Method / notes
1	$\frac{6}{10}$ and $\frac{6}{40}$	Different groups as the denominator (C1); $\frac{6}{10}$ (B1); $\frac{6}{40}$ (B1).
2	Explanation	Restrict to those in B (C1); fraction of them also in A (C1).
3	Shown	9 true positives and 99 false positives (M1); $\frac{9}{108}$ (M1); most people do not have the disease, so most positives are false (C1).
4	Independent	Knowing B does not change $P(A)$ (C2).
5	Shown	30 drink coffee (M1); $\frac{10}{30}$ (C1).
6	Explanation	It depends on what was picked first (C2).
7	Shown	$0.12 + 0.07$ (M1); C1; $\frac{0.12}{0.19}$ (C1).
8	Explanation	The groups you divide by are different (C1).
9	Yes	Being in Year 10 does not change the probability (C2).