

ASSIGNMENT: Algebraic Probability

89.) For events A and B , the probabilities are $P(A) = \frac{3}{11}$, $P(B) = \frac{4}{11}$.

Calculate the value of $P(A \cap B)$ if

(a) $P(A \cup B) = \frac{6}{11}$;

(b) events A and B are independent.

75.) Let A and B be events such that $P(A) = \frac{1}{2}$, $P(B) = \frac{3}{4}$ and $P(A \cup B) = \frac{7}{8}$.

(a) Calculate $P(A \cap B)$.

(b) Calculate $P(A|B)$.

(c) Are the events A and B independent? Give a reason for your answer.

61.) Events E and F are independent, with $P(E) = \frac{2}{3}$ and $P(E \cap F) = \frac{1}{3}$. Calculate

(a) $P(F)$;

(b) $P(E \cup F)$.

89.) (a) $P(A \cup B) = P(A) + P(B) - P(A \cap B) \Rightarrow P(A \cap B) = P(A) + P(B) - P(A \cup B)$ (M1)

$$= \frac{3}{11} + \frac{4}{11} - \frac{6}{11} \quad (\text{M1})$$

$$= \frac{1}{11} \quad (0.0909) \quad (\text{A1}) \quad (\text{C3})$$

(b) For independent events, $P(A \cap B) = P(A) \times P(B)$ (M1)

$$= \frac{3}{11} \times \frac{4}{11} \quad (\text{A1})$$

$$= \frac{12}{121} \quad (0.0992) \quad (\text{A1}) \quad (\text{C3})$$

[6]

75.) (a) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (M1)

$$P(A \cap B) = \frac{1}{2} + \frac{3}{4} - \frac{7}{8}$$

$$= \frac{3}{8} \quad (\text{A1}) \quad (\text{C2})$$

(b) $P(A|B) = \frac{P(A \cap B)}{P(B)} = \left(\frac{\frac{3}{8}}{\frac{3}{4}} \right)$ (M1)

$$= \frac{1}{2} \quad (\text{A1}) \quad (\text{C2})$$

(c) Yes, the events are independent (A1) (C1)

EITHER

$$P(A|B) = P(A) \quad (\text{R1}) \quad (\text{C1})$$

OR

$$P(A \cap B) = P(A)P(B) \quad (\text{R1}) \quad (\text{C1})$$

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61.) (a) For attempting to use the formula $(P(E \cap F) = P(E)P(F))$ (M1)

Correct substitution or rearranging the formula A1

$$\text{eg } \frac{1}{3} = \frac{2}{3} P(F), P(F) = \frac{P(E \cap F)}{P(E)}, P(F) = \frac{\frac{1}{3}}{\frac{2}{3}}$$

$$P(F) = \frac{1}{2} \quad (\text{A1}) \quad (\text{N2})$$

(b) For attempting to use the formula $(P(E \cup F) = P(E) + P(F) - P(E \cap F))$ (M1)

$$P(E \cup F) = \frac{2}{3} + \frac{1}{2} - \frac{1}{3} \quad (\text{A1})$$

$$= \frac{5}{6} (=0.833) \quad (\text{A1}) \quad (\text{N2})$$

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