

Cambridge International AS & A Level

Mathematics

9709/52

Paper 5 Probability & Statistics 1

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Question No (2)

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Question No (2)

Seva has a coin which is biased so that when it is thrown the probability of obtaining a head is $\frac{1}{3}$. He also has a bag containing 4 red marbles and 5 blue marbles.

Seva throws the coin. If he obtains a head, he selects one marble from the bag at random. If he obtains a tail, he selects two marbles from the bag at random and without replacement.

- (a) Find the probability that Seva selects at least one red marble.
 (b) Find the probability that Seva obtains a head given that he selects no red marbles.

Solution:**(a)**

DATE :-

AS given

$$P(H) = \frac{1}{3}, \quad P(T) = 1 - \frac{1}{3} = \frac{2}{3}$$

$$P(HR) + P(HRR) + P(TRB) + P(TBR)$$

$$= \frac{1}{3} \times \left(\frac{4}{9}\right) + \frac{2}{3} \times \left(\frac{4}{9} \times \frac{3}{8}\right) + \frac{2}{3} \times \left(\frac{4}{9} \times \frac{5}{8}\right) + \frac{2}{3} \times \left(\frac{5}{9} \times \frac{4}{8}\right)$$

$$= \frac{4}{27} + \frac{24}{216} + \frac{40}{216} + \frac{40}{216}$$

$$= \frac{32 + 24 + 40 + 40}{216}$$

$$= \frac{136}{216} = \frac{68}{108} = \frac{34}{54} = \frac{17}{27}$$

(b)

It's about the conditional probability

conditional probability

is the probability that an event A happens given that another event B

has already happened.

It is written as:

$$P(A|B)$$

and read as "the probability of A given B"

Formula

$$P(A|B) = \frac{P(A \cap B)}{P(B)} \quad \text{where } P(B) > 0$$

- $P(A \cap B)$ = probability that both A and B happen
- $P(B)$ = probability that B happens.

$$P(\text{head} | \text{no reds}) = \frac{P(\text{head} \cap \text{no reds})}{P(\text{no reds})}$$

$$= \frac{\frac{1}{3} \times \frac{5}{9}}{P(H|B) + P(T|B)}$$

$$= \frac{\frac{5}{27}}{\frac{1}{3} \times \frac{5}{9} + \frac{2}{3} \times \frac{5}{9} \times \frac{4}{2}}$$

$$= \frac{\frac{5}{27}}{\frac{5}{27} + \frac{5}{27}} = \frac{\frac{5}{27}}{\frac{10}{27}}$$

$$= \frac{5}{10} = \frac{1}{2}$$

