ILLAWARRA TUTORING

This worksheet focuses on the addition rule of probability. You will learn how to combine probabilities for events that are mutually exclusive and those that are not mutually exclusive. For mutually exclusive events, remember that $P(A \cup B) = P(A) + P(B)$, while for non–mutually exclusive events, the rule becomes $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. Work through each question and show your reasoning.

Easy Questions

1. Write the expression for the probability of either event A or event B occurring if A and B are mutually exclusive, given that $P(A) = 0.3$ and $P(B) = 0.4$. What is $P(A \cup B)$?

2. Given that events A and B are mutually exclusive with $P(A) = 0.2$ and $P(B) = 0.5$, compute the probability that either A or B occurs.

3. Events A and B are mutually exclusive. If $P(A \cup B) = 0.8$ and $P(A) = 0.5$, find $P(B)$.

4. Write, in your own words, the addition rule used when events are mutually exclusive.

5. Answer the following: If two events are mutually exclusive, is it possible for them to occur simultaneously? Explain your answer.

Intermediate Questions

6. Given events A and B are not mutually exclusive, where $P(A) = 0.45$, $P(B) = 0.35$, and $P(A \cap B) = 0.15$, calculate $P(A \cup B)$.

7. In a survey, 60% of people like tea and 50% like coffee. If 20% like both, determine the probability that a randomly chosen person likes either tea or coffee.

8. In an exam, 30% of students failed mathematics, 20% failed science, and 10% failed both subjects. Using the addition rule, find the probability that a randomly selected student failed at least one of the subjects.

9. Events A and B have $P(A) = 0.7$, $P(B) = 0.5$, and $P(A \cap B) = 0.2$. Find $P(A \cup B)$.

10. For events A and B, if $P(A) = 0.5$, $P(B) = 0.6$, and $P(A \cup B) = 0.8$, determine $P(A \cap B)$.

11. In a standard deck of 52 cards, define event A as drawing a red card and event B as drawing a queen. Given there are 26 red cards, 4 queens, and 2 red queens, use the addition rule to calculate the probability of drawing a red card or a queen.

12. Given events A and B with $P(A) = 0.55$, $P(B) = 0.45$, and $P(A \cup B) = 0.75$, use the addition rule to find $P(A \cap B)$.

13. A bag contains only red and blue marbles. The probability of drawing a red marble is 0.4, and that of drawing a blue marble is 0.5. If the probability of drawing a marble that is both red and blue (a special case) is 0.1, compute $P(\text{red or blue marble})$.

14. Consider events A and B with probabilities $P(A) = 0.6$, $P(B) = 0.7$, and $P(A \cap B) = 0.4$. Verify that these probabilities are possible for non–mutually exclusive events and then calculate $P(A \cup B)$.

15. If $P(A \cup B) = 0.85$, $P(A) = 0.5$, and $P(B) = 0.55$, find $P(A \cap B)$.

16. For events A and B with $P(A) = 0.3$, $P(B) = 0.4$, and $P(A \cap B) = 0.05$, compute $P(A \cup B)$.

17. In a class, 40% of students like soccer and 30% like cricket, with 10% liking both sports. Use the addition rule to find the percentage of students that like either soccer or cricket.

18. A survey shows 70% of respondents own a smartphone and 40% own a tablet. If 30% own both devices, what is the probability that a respondent owns either a smartphone or a tablet?

19. Two events A and B have $P(A) = 0.25$, $P(B) = 0.35$, and $P(A \cup B) = 0.55$. Are events A and B mutually exclusive? Explain your reasoning.

20. In a brief paragraph, explain why we subtract $P(A \cap B)$ when using the addition rule for events that are not mutually exclusive.

Hard Questions

21. In a school, 55% of students play soccer and 40% play basketball, with 25% playing both. Use the addition rule to find the probability that a randomly selected student plays either soccer or basketball.

22. A survey found that 65% of people read a daily newspaper and 45% watch the news on television, with 20% doing both. Calculate the probability that a randomly chosen person engages in at least one of these activities and explain your answer.

23. A jar contains 10 red, 15 blue, and 5 green balls. Define event A as drawing a red or blue ball and event B as drawing a blue or green ball. Using the addition rule, compute $P(A \cup B)$.

24. Suppose events A and B have $P(A) = 0.4$, $P(B) = 0.3$, and $P(A \cap B) = 0.1$. If event C is defined as "either A or B occurs", write an expression for $P(C)$ using the addition rule and determine its value.

25. Given $P(A) = 0.48$, $P(B) = 0.52$, and $P(A \cup B) = 0.80$, use the addition rule to show that $P(A \cap B) = 0.20$. Based on your result, explain whether A and B are mutually exclusive.

26. If $P(A) = 0.15$, $P(B) = 0.25$, and $P(A \cup B) = 0.33$, use the addition rule to calculate $P(A \cap B)$. What does your answer suggest about the relationship between A and B?

27. In a lottery, the probability of winning a small prize is 0.12 and that of winning a medium prize is 0.08. If these events can overlap with $P(\text{small} \cap \text{medium}) = 0.02$, use the addition rule to determine the probability of winning either a small or a medium prize.

28. A town survey shows that 55% of households own a car and 30% own a motorcycle, with 15% owning both. Calculate the probability that a randomly selected household owns either a car or a motorcycle.

29. Consider a bag containing special coins. Event A is selecting a coin that shows heads with $P(A) = 0.5$, and event B is selecting a coin with a mark with $P(B) = 0.6$. If $P(A \cap B) = 0.3$, find $P(A \cup B)$ using the addition rule.

30. Provide a real-life scenario in which the addition rule for non–mutually exclusive events is applied. Write a brief description of the scenario and demonstrate step by step how to use the addition rule to find the probability of the combined event.