ILLAWARRA TUTORING

This worksheet focuses on the multiplication rule of probability. Students will master how to calculate the probability of two or more events occurring together using the multiplication rule. Both independent events, where one event does not affect the other, and dependent events, where the occurrence of one event alters the subsequent probability, are explored.

Easy Questions

1. Consider two independent events A and B where $P(A) = \frac{1}{2}$ and $P(B) = \frac{1}{3}$. Calculate the probability that both A and B occur.

2. A fair coin is tossed and a fair six-sided die is rolled. Write down the probability of getting a head and a 4 on the die.

3. Two independent spinners are used in a game. If the probability of spinner 1 landing on a winning section is $\frac{3}{5}$ and the probability of spinner 2 landing on a winning section is $\frac{2}{3}$, what is the probability of both spinners landing on a winning section?

4. Two independent six-sided dice are rolled. Assuming each die is fair, find the probability that the first die shows a 3 and the second die shows an even number.

5. Write an expression using the multiplication rule of probability to represent the probability of two events A and B happening together.

Intermediate Questions

6. Given that events A and B are independent with $P(A) = \frac{2}{5}$ and $P(B) = \frac{3}{4}$, calculate $P(A \text{ and } B)$.

7. A bag contains 3 red balls and 5 blue balls. Two balls are drawn one after the other without replacement. Determine the probability that both balls drawn are red.

8. In a survey, 70% of respondents like tea and 60% like coffee. If the events are independent, find the probability that a respondent likes both tea and coffee.

9. A jar contains 4 green and 6 yellow marbles. A marble is picked at random, replaced, and then another marble is picked. What is the probability that both marbles chosen are green?

10. A computer randomly selects a letter from the word [PROBABILITY] and then randomly selects a digit from [0,1,2,3,4]. Assuming independence, compute the probability that the letter selected is a vowel and the digit selected is even.

11. In a deck of 20 uniquely numbered cards, one card is drawn and not replaced. Then a second card is drawn. If the probability of drawing a card with a number less than 5 on the first draw is $\frac{4}{20}$, find the probability that both drawn cards have numbers less than 5.

12. A fair coin is tossed twice. What is the probability of getting head on the first toss and tail on the second toss?

13. A box has 7 defective and 13 non-defective items. If one item is drawn, replaced, and then another is drawn, what is the probability that both drawn items are non-defective?

14. Explain why rolling a die and spinning a spinner with outcomes 1 to 4 are independent events and use the multiplication rule to calculate the probability of rolling a 6 and spinning a 3.

15. If $P(C) = 0.4$ and $P(D) = 0.25$ and events C and D are independent, calculate $P(C \text{ and } D)$.

16. An urn contains 8 balls: 3 are white and 5 are black. Two balls are drawn without replacement. Find the probability that the first ball is white followed by a black ball.

17. A factory produces gadgets. 90% are tested and found to be working, and 80% of the working gadgets pass a quality check. Assuming independence between testing and quality check, what is the probability that a randomly chosen gadget is both working and passes the quality check?

18. A spinner has 4 equal sectors numbered [1,2,3,4]. If the probability of landing on a prime number on the spinner is needed for two independent spins, calculate the probability that both spins result in a prime number.

19. Write an expression using multiplication for the probability of event E occurring and then event F occurring when the events are dependent.

20. A bowl contains 10 candies, 4 of which are mint and 6 are fruit-flavoured. If one candy is selected at random without replacement and then a second candy is selected, what is the probability that the first candy is mint and the second is fruit-flavoured?

Hard Questions

21. An urn contains 5 red, 4 blue, and 3 green balls. Three balls are drawn without replacement. Calculate the probability that the balls are drawn in the following order: red, blue, green.

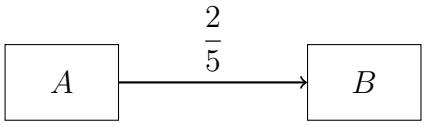
22. From a standard deck of 52 cards, one card is drawn, not replaced, and then a second card is drawn. Using the multiplication rule, find the probability that the first card is an ace and the second card is a king.

23. A bag contains 6 white and 4 black balls. Two balls are drawn under two different conditions: (a) With replacement. (b) Without replacement. Using the multiplication rule, compute the probability that both balls drawn are black in each case.

24. A survey finds that 80% of households have a computer. Of the households with a computer, 50% subscribe to high-speed internet. Assuming the events are independent, calculate the probability that a randomly selected household has both a computer and high-speed internet.

25. A jar contains 12 tokens: 5 are marked with a star and 7 with a circle. Two tokens are drawn without replacement. First, determine whether these events are independent or dependent and then compute the probability that both tokens drawn are marked with a star.

26. Below is a diagram representing two sequential events. Use the multiplication rule to calculate the overall probability if $P(A) = \frac{3}{7}$ and after event A the probability of event B occurring is $\frac{2}{5}$.



27. A factory produces parts in three stages. The probability that a part passes stage 1 is 0.9. Given that it passes stage 1, the probability that it passes stage 2 is 0.8 and given it also passes stage 2, the probability that it passes stage 3 is 0.85. Use the multiplication rule to find the probability that a part passes all three stages.

28. In a school, 65% of students participate in sports. Of those, 40% also participate in music. Determine the probability that a randomly chosen student participates in both sports and music.

29. A game consists of three independent rounds. The probability of winning each round is 0.6, 0.5 and 0.4 respectively. Calculate the probability of winning all three rounds.

30. A box contains 15 chips, 6 of which are red and 9 are blue. Two chips are drawn one after the other without replacement. After replacing the drawn chips, a coin is tossed. Using the multiplication rule, determine the probability that the first draw is red, the second draw is blue, and the coin toss results in heads. (Assume the coin is fair.)