



MATHS

BOOKS - VIKRAM PUBLICATION (ANDHRA PUBLICATION)

PROBABILITY

Example Solved Problem

1. Find the probability of getting the same number on the both the dice when two dice are thrown.

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2. An integer is picked from 1 to 20, both inclusive. Find the probability that it is a prime.

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3. A bag contains 4 red, 5 black and 6 blue balls. Find the probability that two balls drawn at random simultaneously from the bag are a red and a black ball.



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4. Ten dice are thrown. Find the probability that none of the dice shows the number 1.



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5. A number x is drawn arbitrality from the set $\{1,2,3, \dots,100\}$. What is the probability that $\left(x + \frac{100}{x}\right) > 29$



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6. Two squares are chosen at random on a chess board. Show that the probability that they have a side in common is $\frac{1}{18}$.

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7. A fair coin is tossed 200 times. Find the probability of getting a head an odd number of times.

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8. A and B are among 20 persons sit at random along a round table. Find the probability that there are any 6 persons between A and B.

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9. Out of 30 consecutive integers two are drawn at random. Then what is the probability that their sum is odd.



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10. Out of 1,00,000 new born babies 77,181 survived till the age of 20. Find the probability that a new baby survives till 20 years of age.



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11. Addition theorem on probability :

Statement : if $(E_1), (E_2)$ an any two events of a random experiment and

P is a probability function, then

$$P(E_1 \cup E_2) = P(E_1) + P(E_2) - P(E_1 \cap E_2)$$



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12. Find is the probability of throwing a total score of 7 with two dice.



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13. Find the probability of obtaining two tails and one head when three coins are tossed.

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14. A page is opened at random from a book containing 200 pages. What is the probability that the number of the page is a perfect square ?

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15. Find the probability of drawing and ace or a spade from a well suffled pack of 52 cards ?

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16. If A and B are two events, show that

i) $P(A \cap B^C) = P(A) - P(A \cap B)$ and

ii) the probability that one of them occurs is given by

$$P(A) + P(B) - 2P(A \cap B)$$

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17. Suppose A and B are events with $P(A)=0.5$, $P(B)=0.4$ and $P(A \cap B) = 0.3$. Find the probability that i) A does not occur,

ii) neither A nor B occurs.

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18. If A,B,C are three events, Show that

$$p(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(C$$

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19. MULTIPLICATION THEOREM OF PROBABILITY

Statement : If A and B are two events of a random experiment and

$P(A) > 0$ and $P(B) > 0$ then

$$P(A \cap B) = P(A)P\left(\frac{B}{A}\right) = P(B)P\left(\frac{A}{B}\right)$$

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20. A pair of dice of thrown. Find probability that either of the dice shows 2 when their sum is 6.

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21. A box contains 4 defective and 6 good bulbs. Two bulbs are drawn at random without replacement. Find the probability that the both the bulbs drawn are good.

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22. Suppose there are 12 boys and 4 girls in a class. If we choose three children one after another in succession, what is the probability that all

the three are boys ?



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23. A speaks the truth in 75% of the cases , B in 80% cases. What is the probability that their statements about an incident do not match ?



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24. A problem in Calculus is given to two students A and B whose chances of solving it are $\frac{1}{3}$ and $\frac{1}{4}$. What is the probability that the problem will be solved if both of them try independently ?



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25. A and B toss a fair coin 50 times each simultaneously. Then find the probability that both of them will not get tails at the same toss



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26. If A and B are independent events of a random experiment show that A^C and B^C are also independent.



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27. A bag contains 10 identical balls, of which 4 are blue and 6 are red. Three balls are taken out at random from the bag one after the other. Find the probability that all the three balls drawn are red without replacement.



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28. An urn contains 7 red and 3 black balls.

Two balls are drawn without replacement.

What is the probability that the second ball is red it is known that the first ball drawn is red.



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29. Let A and B be independent events with

$$P(A)=0.2, P(B)=0.5.$$

find $P(A/B)$, $P(B/A)$, $P(A \cup B)$ and $P(A \cap B)$



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30. Bag B_1 contains 4 white and 2 black balls.

Bag B_2 contains 3 white and 4 black balls.

A bag is drawn at random and a ball is chosen at random from it. What is the probability that the ball drawn is white.



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31. An urn contains w white balls and b black balls. Two players Q and R alternately draw a with replacement from the urn. The player that draws a

white ball first wins the game. If Q begins the game, find the probability that Q wins the game.

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Exercise 9 A

1. In the experiment of throwing a die, consider the following events:

$$A=\{1,3,5\}, B=\{2,4,6\}, C=\{1,2,3\}$$

Are these events equally likely?

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2. In the experiment of throwing a die, consider the following events:

$$A=\{1,3,5\}, B=\{2,4\}, C=\{6\}$$

Are these events mutually exclusive ?

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3. In the experiment of throwing a die, consider the events.

$A=\{2,4,6\}$, $B=\{3,6\}$, $C=\{1,5,6\}$

Are these events exhaustive?

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4. Give two examples of mutually exclusive and exhaustive events.

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5. Give examples of two events that are neither mutually exclusive nor exhaustive.

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6. Give two examples of events that are neither equally likely nor exhaustive.

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Exercise 9 B

1. If 4 fair coins are tossed simultaneously, then find the probability that 2 heads and 2 tails appear.

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2. Find the probability that a non- leap year contains i) 53 Sunday ii) 52 Sundays only.

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3. Two dice are rolled. What is the probability that none of the dice shows the number 2 ?

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4. In an experiment of drawing a card at random from a pack, the event of getting a spade is denoted by A and getting a picture card (king, Queen or jack) is denoted by B . Find the probabilities of A , B , $A \cap B$ and $A \cup B$.

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5. In a class of 60 boys and 20 girls, half of the boys and half of the girls know cricket.

Find the probability of the event that a person selected from the class is either a boy or girl who knows cricket.

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6. For any two events A and B , shows that

$$P(A^C \cap B^C) = 1 - P(A \cup B) = 1 - P(A) - P(B) + P(A \cap B).$$

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7. Two persons A and B are rolling die on the condition that the person who gets 3 will win the game. If A starts the game, then find the probabilities of A and B respectively to win the game.



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8. A,B,C are 3 newspaper from a city. 20% of the population read A, 16% read B, 14% read C, 8% both A and B, 5% both A and C, 4% both B and C, 2% all the three. Find the percentage of the populations who read atleast one newspaper.



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9. If one ticket is randomly selected from tickets numbered 1 to 30. Then find the probability that the number on the ticket is.

i) a multiple of 5 or 7

ii) a multiple of 3 or 5



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10. If two numbers are selected randomly from 20 consecutive natural numbers, find the probability that the sum of the two numbers is (i) an even number (ii) an odd number.

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11. A game consists of tossing a coin 3 times and noting its outcome. A boy wins if all tosses give the same outcomes and loses otherwise. Find the probability that the boy loses the game.

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12. If E_1, E_2 are two events with $E_1 \cap E_2 = \phi$ then show that
$$P(E_1^C \cap E_2^C) = P(E^C) - P(E_2)$$

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13. A pair of dice rolled 24 times. A person wins by not getting a pair of 6's on any of the 24 rolls. What is the probability of his winning?



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14. If P is a probability function, then show that for any two events A and B .

$$P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$$



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15. In a box containing 15 bulbs, 5 are defective.

If 5 bulbs are selected at random from the box, find the probability of the event, that

- (i) None of them is defective
- (ii) Only one of them is defective.
- (iii) Atleast one of them is defective.



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16. A and B are seeking admission into I.I.T. If the probability for A to be selected is 0.5 and that both to be selected is 0.3. Is it possible that the probability of B to be selected is 0.9?



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17. The probability for a contractor to get a road contract is $\frac{2}{3}$ and to get a building contract is $\frac{5}{9}$. The probability to get atleast on contract is $\frac{4}{5}$. Find the probability to get both the contracts.



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18. In a committee of 25 members, each member is proficient either in Mathematics or in Statistics or in both. If 19 of these are proficient in Mathematics, 16 in statistics, find the probability that a person selected from the committee is proficient in both.



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19. A,B,C are three horses in a race. The probability of A to win the race is twice that of B and probability of B is twice that of C. What are the probability of A,B and C to win the race?

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20. A bag contains 12 two rupee coins, 7 one rupee coins and 4 half rupee coins. If 3 coins are selected at random find the probability that

- i) The sum of the 3 coins is maximum
- ii) The sum of the 3 coins is minimum
- iii) Each coin is of different value.

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21. The probabilities of three events A,B,C are such that $P(A)=0.3$, $P(B)=0.04$, $P(C) = 0.8$ $P(A \cap B) = 0.08$

$P(A \cap C) = 0.28$, $P(A \cap B \cap C) = 0.09$ and

$P(A \cup B \cup C) \geq 0.75$. Show that $P(B \cap C)$ lies in the interval $[0.23, 0.48]$



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22. The probabilities of three mutually exclusive events are respectively

given as $\frac{1+3P}{3}$, $\frac{1-P}{4}$, $\frac{1-2P}{2}$. Prove that

$$\frac{1}{3} \leq P \leq \frac{1}{2}$$



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23. On a festival day, a man plans to visit 4 holy temples A,B,C,D in a random order.

Find the probability that he visits (i) A before B (ii) A before B and B before C.



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24. Out of 100 students, two sections of 40 are formed. If you and your friend are among the 100 students, find the probability that

- i) You both enter the same section.
- ii) You both enter the different sections.



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Exercise 9 C

1. Three screws are drawn at random from a lot of 50 screws, 5 of which are defective.

Find the probability of the event that all 3 screws are non-defective assuming that the drawing is a) with replacement b) without replacement.



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2. If A,B,C are three independent events of an experiment. Such that

$$P(A \cap B^C \cap C^C) = \frac{1}{4}$$

$$P(A^C \cap B \cap C^C) = \frac{1}{8}, P(A^C \cap B^C \cap C^C) = \frac{1}{4}$$

then find P(A),P(B)and P(C).



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3. There are 3 black and 4 white balls in one bag. 4 black and 3 white balls in the second bag. A die is rolled and the first bag is selected if it is 1 or 3 and the second bag for the rest. Find the probability of drawing a black ball from the bag thus selected.



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4. A,B,C are aiming to shoot a balloon. A will succeed 4 times out of 5 attempts. The chance of B to shoot the balloon is 3 out of 4 and that of C is 2 out of 3. If three aim the balloon simultaneously, then find the probability that atleast two of them hit the balloon.



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5. If A,B are two events, then show that

$$P\left(\frac{A}{B}\right)P(B) + P\left(\frac{A}{B^C}\right)P(B^C) = P(A).$$



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6. A pair of dice are rolled.What is the probability that they sum of 7, given that neither die shows a 2 ?



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7. A pair of dice are rolled. What is the probability that neither die shows a 2, given that they sum to 7 ?



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8. An urn contains 12 red balls and 12 green balls. Suppose two balls are drawn one after another without replacement . Find the probability that the second ball drawn is green given that the first ball drawn is red.



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9. A single die is rolled twice in succession. What is the probability that the number showing on the second toss is greater than that on the first rolling?



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10. If one card is drawn at random from a pack of cards then show that event of getting an ace and getting heart are independent events.



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11. The probability that a boy A will get a scholarship is 0.9 and that another boy B will get is 0.8. What is the probability that atleast one of them will get the scholarship?

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12. If $A, B,$ are two events with $P(A \cup B) = 0.65,$ and $P(A \cap B) = 0.15,$ then find the value of $P(A^C) + P(B^C).$

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13. If A, B, C are independent events, shows that $A \cup B$ and C are also a independent events.

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14. A and B are two independent events such that the probability of the both the events to occurs is $\frac{1}{6}$ and the probability of both the events do not occur is $\frac{1}{3}$. Find the probability of A.



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15. A fair die is rolled. Consider the events.

$A=\{1,3,5\}, B=\{2,3\}$ and $C = \{2,3,4,5\}$.

Find

A. $P(A \cap B), P(A \cup B)$

B. $P\left(\frac{A}{B}\right), P\left(\frac{B}{A}\right)$

C. $P\left(\frac{A}{C}\right), P\left(\frac{C}{A}\right)$

D. $P\left(\frac{B}{C}\right), P\left(\frac{C}{B}\right)$

Answer: = 1



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16. If A,B,C are three events in a random experiment, Prove the following.

$$P\left(\frac{A}{A}\right) = 1$$

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17. If A,B,C are three events in a random experiment, Prove the following.

$$P\left(\frac{\phi}{A}\right) = 0$$

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18. If A,B,C are three events in a random experiment, Prove the following.

$$A \subseteq B \Rightarrow P\left(\frac{A}{C}\right) \leq P\left(\frac{B}{C}\right)$$

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19. If A,B,C are three events in a random experiment, Prove the following.

$$P(A - B) = P(A) - P(A \cap B)$$



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20. If A,B are mutually exclusive and

$$P(B) > 0 \text{ then } P\left(\frac{A}{B}\right) = 0.$$



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21. If A,B, are ,mutually exclusive then

$$P\left(A/B^C\right) = \frac{p(A)}{1 - P(B)}, \text{ when } P(B) \neq 1$$



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22. If A,B are mutually exclusive and $P(A \cup B) \neq 0$

$$\text{then } p\left(\frac{A}{A \cup B}\right) = \frac{P(A)}{P(A) + P(B)}.$$



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23. Suppose that a coin is tossed three times. Let A be "getting three heads" and B be the event of "getting a head on the first toss". Show that A and B are dependent events.



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24. Suppose that an unbiased pair of dice is rolled. Let A denote the event that the same number shows on each die. Let B denote the event that the sum is greater than 7. Find (i) $P\left(\frac{A}{B}\right)$ ii) $P\left(\frac{B}{A}\right)$



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25. Prove that A and B are independent events if and only if $P\left(\frac{A}{B}\right) = P\left(\frac{A}{B^c}\right)$



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26. Suppose A and B are independent events with $P(A)=0.6$, $P(B)=0.7$ then compute

A. $P(A \cap B)$

B. $P(A \cup B)$

C. $P\left(\frac{B}{A}\right)$

D. $P(A^C \cap B^C)$.

Answer: = 0.12



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27. The probability that Australia wins a match against India in a cricket game is given to be $\frac{1}{3}$. If india and Australia play 3 matches, what is the probability that,

i) Australia will loose all the three matches ? ii) Australia will win atleast one match ?



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28. A person secures a job in a construction company in which the probability that the workers go on strike is 0.65 and the probability that the construction job will be completed on time if there is no strike is 0.80. If the probability that the construction job will be completed on time even if there is a strike is 0.32, determine the probability that the constructed job will be completed on time.



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29. For any two events A,B shows that

$$\begin{aligned} P(A \cap B) - P(A)P(B) &= P(A^C)P(B) - P(A^C \cap B) \\ &= P(A)P(B^C) - P(A \cap B^C) \end{aligned}$$



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30. Three Urns have the following composition of balls.

Urn I : 1 white, 2 black

Urn II : 2 white, 1 black

Urn III : 2 white, 2 black

One of the Urn is selected at random and a ball is drawn. It turns out to be white. Find the probability that it come from Urn III.



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31. In a shooting test the probability of A,B,C hitting the targets are $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{3}{4}$ are respectively. If all of them first at the same target. Find the probability that

- i) Only one of them hits the target,
- ii) atleast one of them hits the target.



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32. In a certain college, 25% of the boys and 10% of the girls are studying mathematics.

The girls constitute 60% of the student strength. If a student selected at

random is found studying mathematics, find the probability that the students is a girl.

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33.4 A person is known to speak truth 2 out of 3 times. He throws a die and reports that it is 1. Find the probability that it is actually 1.

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1. If 4 fair coins are tossed simultaneously, then find the probability that 2 heads and 2 tails appear.

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2. Find the probability that a non-leap year contains i) 53 sundays ii) 52 Sundays only.

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3. If one ticket is randomly selected from tickets numbered 1 to 30. Then find the probability that the number on the ticket is a multiple of 3 or 5.

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4. If two numbers are selected randomly from 20 consecutive natural numbers, find the probability that the sum of the two numbers is (i) an even number (ii) an odd number.

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5. The probability for a contractor to get a road contract is $\frac{2}{3}$ and to get a building contract is $\frac{5}{9}$. The probability to get atleast on contract is $\frac{4}{5}$.

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6. If one card is drawn at random from a pack of cards then show that event of getting an ace and getting heart are independent events.



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7. If A,B, are two events with $P(A \cup B) = 0.65$, and $P(A \cap B) = 0.15$, then find the value of $P(A^C) + P(B^C)$.



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8. Suppose A and B are independent events with $P(A)=0.6$, $P(B)=0.7$ then compute

A. $P(A \cap B)$

B. $P(A \cup B)$

C. $P\left(\frac{B}{A}\right)$

D. $P(A^C \cap B^C)$.

Answer:



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9. Find the probability of drawing and ace or a spade from a well suffled pack of 52 cards ?



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10. If A, B, C are three events, Show that

$$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(C \cap A) + P(A \cap B \cap C)$$

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11. A speaks the truth in 75 % of the cases : B in 80 % cases. What is the probability that their statements about an incident do not match ?

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12. A problem in Calculus is given to two students A and B whose chances of solving it are $\frac{1}{3}$ and $\frac{1}{4}$. What is the probability that the problem will be solved if both of them try independently ?

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