Probability JEE Main PYQ - 3

Total Time: 1 Hour : 15 Minute **Total Marks:** 120

Instructions

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1. Test will auto submit when the Time is up.
2. The Test comprises of multiple choice questions (MCQ) with one or more correct answers.
3. The clock in the top right corner will display the remaining time available for you to complete the examination.

Navigating & Answering a Question

1. The answer will be saved automatically upon clicking on an option amongst the given choices of answer.
2. To deselect your chosen answer, click on the clear response button.
3. The marking scheme will be displayed for each question on the top right corner of the test window.

Probability

1. Two marbles are drawn in succession from a box containing 10 red, 30 white, 20 blue and 15 orange marbles, with replacement being made after each drawing. Then the probability, that first drawn marble is red and second drawn marble is white, is **(+4, -1)**

   a. $\frac{2}{25}$

   b. $\frac{4}{25}$

   c. $\frac{2}{3}$

   d. $\frac{4}{75}$

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2. A bag contains 8 balls, whose colours are either white or black. 4 balls are drawn at random without replacement and it was found that 2 balls are white and other 2 balls are black. The probability that the bag contains equal number of white and black balls is: **(+4, -1)**

   a. $\frac{2}{5}$

   b. $\frac{2}{7}$

   c. $\frac{1}{7}$

   d. $\frac{1}{5}$

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3. A fair die is tossed repeatedly until a six is obtained. Let X denote the number of tosses required and let $a = P(X = 3), b = P(X \geq 3)$, and $(c = P(X \geq 6|X > 3)$. Then $\frac{b+c}{a}$ is equals to ____. **(+4, -1)**

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4. An integer is chosen at random from the integers 1,2, 3, ..., 50. The probability that the chosen integer is a multiple of atleast one of 4, 6 and 7 is **(+4, -1)**

   a. $\frac{8}{25}$

   b. $\frac{21}{50}$

   c. $\frac{9}{50}$

   d. $\frac{14}{25}$

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5. A fair die is thrown until the number 2 appears. What is the probability that 2 appears in an even number of throws? **(+4, -1)**

   a. $\frac{5}{6}$

   b. $\frac{1}{6}$

   c. $\frac{5}{11}$

   d. $\frac{6}{11}$

6. An urn contains 6 white and 9 black balls. Two successive draws of 4 balls are made without replacement. The probability that the first draw gives all white balls, and the second draw gives all black balls, is: **(+4, -1)**

a. $\frac{5}{256}$

b. $\frac{2}{715}$

c. $\frac{3}{715}$

d. $\frac{3}{256}$

7. Tetrahedral dice having outcomes (1, 2, 3, 4) has 3 outcomes a, b, c (which are visible). Probability that $ax^2 + bx + c = 0$ has real roots is m/n (m, n are coprime), then m + n =? **(+4, -1)**

a. 4

b. 5

c. 6

d. 7

8. Bag X contains five one-rupee coins, four five rupee coins. Bag Y contains 4 one rupee and 5 five rupees. Bag Z contains 3 one-rupee coins and 6 five rupee coins. If 1 rupee coin is selected at random, what is the probability it is drawn from bag Y? **(+4, -1)**

a. $\frac{1}{3}$

b. $\frac{1}{4}$

c. $\frac{1}{5}$

d. $\frac{1}{6}$

9. Consider a equation $P(x)= ax^2 + bx + c =0$. If a,b,c $\in$ A, were $A = \{1, 2, 3, 4, 5, 6\}$. Then the probability that P(x) has real and distinct roots? **(+4, -1)**

a. $\frac{1}{4}$

b. $\frac{1}{16}$

c. $\frac{25}{108}$

d. $\frac{19}{108}$

10. Consider the equation $ax^2 + bx + c = 0$. Find probability if a, b, c $\in$ A where $A = \{1,2,3, \ldots , 8\}$ that the equation has equal roots. **(+4, -1)**

a. $\frac{1}{512}$

b. $\frac{1}{64}$

c. $\frac{1}{8}$

d. $\frac{1}{4}$

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11. When 4 dice are rolled, then the probability of 16 as a sum is: (+4, -1)

a. $\frac{5^4}{6^4}$

b. $\frac{5^3}{6^4}$

c. $\frac{5^2}{6^4}$

d. $\frac{5}{6^4}$

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12. A person forgets his 4-digit ATM pin code. But he remembers that in the code all the digits are different, the greatest digit is 7 and the sum of the first two digits is equal to the sum of the last two digits. Then the maximum number of trials necessary to obtain the correct code is (+4, -1)

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13. Negation of $p \wedge (q \wedge \neg(p \wedge q))$ is:} (+4, -1)

a. ~(p∨q)

b. p∨q

c. (~(p∧q))∧q

d. (~(p∧q))∨p

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14. **Let $(a+bx+cx^2)^{10} = \sum_{i=0}^{20} p_i x^i$, a,b,c∈N. If p_1=20 and P_2 = 210, then 2(a+b+c) is equal to** (+4, -1)

a. 6

b. 8

c. 12

d. 15

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15. Let the probability of getting head for a biased coin be $\frac{1}{4}$. It is tossed repeatedly until a head appears. Let N be the number of tosses required. If the probability that the equation $64x^2 + 5Nx + 1 = 0$ has no real root is $\frac{p}{q}$, where p and q are co-prime, then q – p is equal to _______. (+4, -1)

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16. The negation of the statement (+4, -1)
(p ∨ q) ∧ (q ∨(~r)) is

a. (p v r) ∧ (~q)

b. ((~p v r)) ∧ (~q)

c. ((~p) v (~q) v(~r)

d. ((~p) v (~q) ∧(~r)

17. Fifteen football players of a club-team are given 15 T-shirts with their names written on the backside. If the players pick up the T-shirts randomly, then the probability that at least 3 players pick the correct T-shirt is (+4, -1)

a. 1/6

b. 5/36

c. 2/15

d. 5/24

18. Let $S = w_1, w_2, \ldots\ldots$ be the sample space associated to a random experiment. Let $P(w_n) = \frac{P(w_{n-1})}{2}, n \geq 2$. Let A=$(2k + 3l : k, l \in \mathbb{N})$ and $B = w_n : n \in A$. Then P(B) is equal to (+4, -1)

a. $\frac{3}{64}$

b. $\frac{1}{16}$

c. $\frac{1}{32}$

d. $\frac{3}{32}$

19. A coin is biased so that a head is twice as likely as a tail. If the coin is tossed 3 times, then the probability of getting two tails and one head is (+4, -1)

a. $\frac{1}{9}$

b. $\frac{2}{9}$

c. $\frac{2}{27}$

d. $\frac{1}{27}$

20. Given set = {1, 2, 3, ..., 50} one number is selected randomly from the set. Find the probability that number is multiple of 4 or 6 or 7. (+4, -1)

a. $\frac{21}{50}$

b. $\frac{18}{50}$

c. $\frac{8}{25}$

d. $\frac{21}{25}$

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21. Bag I contains 3 red, 4 black and 3 white balls and Bag II contains 2 red, 5 black and 2 white balls. One ball is transferred from Bag I to Bag II and then a ball is drawn from Bag II. The ball so drawn is found to be black in colour. Then the probability, that the transferred ball is red, is : **(+4, -1)**

a. $\frac{4}{9}$

b. $\frac{5}{18}$

c. $\frac{1}{6}$

d. $\frac{3}{10}$

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22. Let S = {1, 2, 3, ..., 2022}. Then the probability that a randomly chosen number n from the set S such that HCF (n, 2022) = 1, is **(+4, -1)**

a. $\frac{128}{1011}$

b. $\frac{166}{1011}$

c. $\frac{127}{337}$

d. $\frac{112}{337}$

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23. The probability that Ajay will not go to office is $\frac{1}{5}$ and probability that Ajay and Vijay will not go to the office is $\frac{2}{7}$, if their visits to office is independent of each other, then find the probability that Ajay will go to the office, but Vijay will not go, is **(+4, -1)**

a. $\frac{12}{28}$

b. $\frac{13}{35}$

c. $\frac{18}{35}$

d. $\frac{24}{35}$

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24. Bag A contains 3 white, 7 red balls and bag B contains 3 white, 2 red balls. One bag is selected at random and a ball is drawn from it. The probability of drawing the ball from bag A, if the ball drawn is white, is: **(+4, -1)**

a. $\frac{1}{4}$

b. $\frac{1}{9}$

c. $\frac{1}{3}$

d. $\frac{3}{10}$

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25. An urn contains 15 red, 10 white, 60 orange balls, 15 green balls. 2 balls are taken with replacement. Find the probability 1 ball is red and the other ball is white. **(+4, -1)**

a. $\frac{2}{27}$

b. $\frac{3}{22}$

c. $\frac{1}{33}$

d. $\frac{1}{29}$

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26. A six faced die is biased such that **(+4, -1)**
3 × P (a prime number) = 6 × P (a composite number) = 2 × P (1).
Let X be a random variable that counts the number of times one gets a perfect square on some throws of this die. If the die is thrown twice, then the mean of X is :

a. $\frac{3}{11}$

b. $\frac{5}{11}$

c. $\frac{7}{11}$

d. $\frac{8}{11}$

---

27. Let a die rolled till 2 is obtained. The probability that 2 obtained on even numbered toss is equal to: **(+4, -1)**

a. $\frac{5}{11}$

b. $\frac{5}{6}$

c. $\frac{1}{11}$

d. $\frac{6}{11}$

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28. Let E_1, E_2, E_3 be three mutually exclusive events such that **(+4, -1)**
$P(E_1) = \frac{2+3p}{6}, P(E_2) = \frac{2-p}{8}\ and\ P(E_3) = \frac{1-p}{2}.$
If the maximum and minimum values of p are p_1 and p_2, then $(p_1 + p_2)$ is equal to :

a. $\frac{2}{3}$

b. $\frac{5}{3}$

c. $\frac{5}{4}$

d. 1

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29. Let A and B be two events such that **(+4, -1)**
$P\left(B/A\right)\frac{2}{5},\ P\left(A/B\right) = \frac{1}{7}$ and $P\left(A\cap B\right) = \frac{1}{9}.\ Consider\ \ (S1)\ P\left(A'\cup B\right) = \frac{5}{6},$

$(S2)\ P(A' \cap B') = \frac{1}{18}$. Then

a. Both (S1) and (S2) are true

b. Both (S1) and (S2) are false

c. Only (S1) is true

d. Only (S2) is true

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30. The probability that a randomly chosen one-one function from the set {a, b, c, d} to the set {1, 2, 3, 4, 5} satisfies f(a) + 2f(b) − f(c) = f(d) is : **(+4, -1)**

a. $\frac{1}{24}$

b. $\frac{1}{40}$

c. $\frac{1}{30}$

d. $\frac{1}{20}$

Answers

1. Answer: d

Explanation:

To find the probability that the first drawn marble is red and the second drawn marble is white, with replacement after each drawing, we start by understanding the probability formulas involved:

1. Calculate the total number of marbles in the box:
    - Red marbles: 10
    - White marbles: 30
    - Blue marbles: 20
    - Orange marbles: 15
2. Find the probability of drawing a red marble first:
    - The number of red marbles = 10
    - Probability of red marble = $\frac{10}{75}$ = $\frac{2}{15}$
3. Since replacement is made, the total number of marbles remains 75 for the second draw:
4. Find the probability of drawing a white marble second:
    - The number of white marbles = 30
    - Probability of white marble = $\frac{30}{75}$ = $\frac{2}{5}$
5. By multiplying the probabilities of the two independent events (since replacement is made, they are independent), we find the overall probability:
    - Probability = Probability (Red first) × Probability (White second)
    - = $\frac{2}{15} \times \frac{2}{5} = \frac{4}{75}$

Therefore, the probability that the first drawn marble is red and the second drawn marble is white is $\frac{4}{75}$.

The correct answer is: $\frac{4}{75}$.

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2. Answer: b

Explanation:

Let us denote 4W4B as the case where the bag contains 4 white and 4 black balls. The probability of drawing 2 white and 2 black balls from such a bag is given by:

$$P(4W4B/2W2B) = \frac{P(4W4B) \times P(2W2B/4W4B)}{P(4W4B) \times P(2W2B/4W4B) + P(3W5B) \times P(2W2B/3W5B) + \cdots + P(0W8B) \times P(2W2B/0W8B)}$$

$$= \frac{\frac{1}{5} \times \binom{4}{2} \times \binom{4}{2} / \binom{8}{4}}{\frac{1}{5} \times \binom{2}{2} \times \binom{6}{2} / \binom{8}{4} + \frac{1}{5} \times \binom{3}{2} \times \binom{5}{2} / \binom{8}{4} + \cdots + \frac{1}{5} \times \binom{6}{2} \times \binom{2}{2} / \binom{8}{4}}$$

$$= \frac{\frac{1}{5} \times \frac{4C_2 \times 4C_2}{8C_4}}{\frac{1}{5} \times \frac{2C_2 \times 6C_2}{8C_4} + \frac{1}{5} \times \frac{3C_2 \times 5C_2}{8C_4} + \cdots + \frac{1}{5} \times \frac{6C_2 \times 2C_2}{8C_4}}$$

$$= \frac{\frac{1}{5} \times \frac{6 \times 6}{70}}{\frac{1}{5} \times \frac{15}{70} + \frac{1}{5} \times \frac{30}{70} + \cdots + \frac{1}{5} \times \frac{15}{70}}$$

$$= \frac{\frac{1}{5} \times \frac{6 \times 6}{70}}{\frac{1}{5} \times \frac{15}{70} + \frac{1}{5} \times \frac{30}{70} + \cdots + \frac{1}{5} \times \frac{15}{70}}$$

$$= \frac{\frac{6}{70}}{\frac{15}{70} + \frac{30}{70} + \frac{30}{70} + \frac{15}{70}}$$

$$= \frac{\frac{6}{70}}{\frac{90}{70}} = \frac{6}{90} = \frac{2}{7}.$$

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3. **Answer: 12 - 12**

Explanation:

The task is to calculate $\frac{b+c}{a}$ where $a = P(X = 3)$, $b = P(X \geq 3)$, and $c = P(X \geq 6 | X > 3)$. The problem involves the geometric distribution, where each die roll is an independent event with a probability $p = \frac{1}{6}$ for rolling a six, and $q = \frac{5}{6}$ for not rolling a six.

1. Calculate $a = P(X = 3)$**:**
The probability that the first two rolls are not six, and the third roll is six:
$a = q^2 \times p = \left(\frac{5}{6}\right)^2 \times \frac{1}{6} = \frac{25}{216}$

2. Calculate $b = P(X \geq 3)$**:**
This is the probability that the first two rolls are not six:
$b = q^2 = \left(\frac{5}{6}\right)^2 = \frac{25}{36}$

3. Calculate $c = P(X \geq 6 | X > 3)$**:**
Using the geometric distribution property,
$c = q^2 = \left(\frac{5}{6}\right)^2 = \frac{25}{36}$

4. Calculate $\frac{b+c}{a}$**:**
Plug in the values:
$\frac{b+c}{a} = \frac{\frac{25}{36} + \frac{25}{36}}{\frac{25}{216}} = \frac{\frac{50}{36}}{\frac{25}{216}} = \frac{50}{36} \times \frac{216}{25} = \frac{50 \times 216}{36 \times 25} = \frac{10800}{900} = 12$

The computed value is 12, which fits within the expected range of 12 to 12.

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4. **Answer: b**

Explanation:

To find the probability that an integer chosen at random from the integers 1 to 50 is a multiple of at least one of 4, 6, and 7, we will use the principle of Inclusion-Exclusion. Let's go through the steps:

1. Identify the set of integers divisible by each number:
   - Multiples of 4: The smallest multiple of 4 within 1 to 50 is 4, and the largest is 48. The multiples are 4, 8, 12, ..., 48. This forms an arithmetic sequence where the nth term is 4n.
     The sequence's number of terms, n, can be found from the equation $4n = 48$, giving $n = 12$.
   - Multiples of 6: Similarly, the sequence is 6, 12, 18, ..., 48, and there are 8 terms (since $6n = 48$ gives $n = 8$).
   - Multiples of 7: The sequence is 7, 14, 21, ..., 49, and has 7 terms (since $7n = 49$ gives $n = 7$).
2. Count the multiples of the least common multiples (LCM) of pairs:
   - LCM(4, 6) = 12: The sequence is 12, 24, 36, 48, so there are 4 terms (as $12n = 48$ gives $n = 4$).

- LCM(6, 7) = 42: The sequence is 42, yielding 1 term.
- LCM(4, 7) = 28: The sequence is 28, also yielding 1 term.

3. Count the multiples of the LCM of all three numbers:
   - LCM(4, 6, 7) = 84: Since 84 is greater than 50, it does not contribute any terms within 1 to 50.
4. Apply the Inclusion-Exclusion principle to count the number of integers that are multiples of at least one of 4, 6, or 7:
   Number of multiples = $12 + 8 + 7 - 4 - 1 - 1 + 0 = 21$.
   Thus, there are 21 integers that are multiples of at least one of 4, 6, or 7.
5. Calculate the probability:
   Total number of integers from 1 to 50 is 50.
   Probability P = $\frac{21}{50}$.

By following these steps, we determined that the correct answer is $\frac{21}{50}$.

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5. Answer: c

Explanation:

To solve this problem, we need to determine the probability that the number 2 appears when a fair die is thrown an even number of times.

Consider the following:

- The probability of rolling a 2 on a fair die in a single throw is $\frac{1}{6}$.
- The probability of not rolling a 2 (i.e., rolling any of the other numbers) on a fair die is $\frac{5}{6}$.

We're interested in the scenario where number 2 first appears on an even number of throws. Let's denote the probability that this happens as $P(\text{Even})$.

To find $P(\text{Even})$, consider that if 2 appears on the second throw, then the first throw must not be a 2. Similarly, if 2 appears on the fourth throw, then the first three throws must not be 2, and so on. These scenarios form a geometric progression.

Let's calculate the probability:

- For the 2nd throw: The event sequence is "not 2" then "2", with probability $\left(\frac{5}{6}\right)^1 \times \frac{1}{6} = \frac{5}{36}$.
- For the 4th throw: The event sequence is "not 2", "not 2", "not 2", then "2", with probability $\left(\frac{5}{6}\right)^3 \times \frac{1}{6} = \frac{125}{1296}$.

The probability $P(\text{Even})$ can be expressed as the infinite series:

$$P(\text{Even}) = \frac{5}{36} + \frac{125}{1296} + \cdots = \sum_{k=1}^{\infty} \left(\frac{5}{6}\right)^{2k-1} \times \frac{1}{6}$$

This is an infinite geometric series with the first term $a = \frac{5}{36}$ and common ratio $r = \left(\frac{5}{6}\right)^2$.

The sum of an infinite geometric series is given by:

$$S = \frac{a}{1-r}$$

Now substitute the values:

- $a = \frac{5}{36}$
- $r = \left(\frac{5}{6}\right)^2 = \frac{25}{36}$

Thus,

$$P(\text{Even}) = \frac{\frac{5}{36}}{1 - \frac{25}{36}} = \frac{\frac{5}{36}}{\frac{11}{36}} = \frac{5}{11}$$

This calculation matches the given correct answer, so the final probability that 2 appears in an even number of throws is $\frac{5}{11}$.

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6. Answer: c

Explanation:

To solve this problem, we need to find the probability that the first draw gives all white balls, and the second draw gives all black balls. This requires understanding the concept of probability with respect to combinations.

The urn contains:

- 6 white balls
- 9 black balls
- Total balls = 6 + 9 = 15

We are drawing 4 balls in two successive draws without replacement. Let's calculate the probability step by step:

1. First Draw (4 white balls):
   - The number of ways to choose 4 white balls out of 6 is given by the combination formula: $\binom{6}{4}$.
   - $\binom{6}{4} = \frac{6\times5}{2\times1} = 15.$
2. Total ways to choose any 4 balls from 15 is:
   - $\binom{15}{4} = \frac{15\times14\times13\times12}{4\times3\times2\times1} = 1365.$
3. Probability of first draw giving all white balls is:
   - $\frac{\binom{6}{4}}{\binom{15}{4}} = \frac{15}{1365}.$
4. Second Draw (4 black balls remaining):
   - After the first draw, 4 white balls are removed, leaving 2 white and 9 black balls.
   - The ways to choose 4 black balls from 9 is: $\binom{9}{4}$.
   - $\binom{9}{4} = \frac{9\times8\times7\times6}{4\times3\times2\times1} = 126.$
5. Total ways to choose any 4 balls from remaining 11 is:
   - $\binom{11}{4} = \frac{11\times10\times9\times8}{4\times3\times2\times1} = 330.$
6. Probability of the second draw giving all black balls is:
   - $\frac{\binom{9}{4}}{\binom{11}{4}} = \frac{126}{330}.$
7. Overall probability:
   - Multiply the probabilities of the two events since they are independent: $\frac{15}{1365} \times \frac{126}{330}$.
   - This results in: $\frac{15\times126}{1365\times330}$.
   - Simplifying, we get $\frac{3}{715}$.

The correct answer is therefore $\frac{3}{715}$.

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7. Answer: b

Explanation:

The Correct answer is option is (B) : 5

8. **Answer: a**

Explanation:

The Correct answer is option is (A) : $\frac{1}{3}$

9. **Answer: d**

Explanation:

The Correct answer is option is (D) : $\frac{19}{108}$

10. **Answer: b**

Explanation:

The Correct answer is option is (B) : $\frac{1}{64}$

11. **Answer: b**

Explanation:

The Correct answer is option is (B) : $\frac{5^3}{6^4}$

12. **Answer: 72 - 72**

Explanation:

To solve the problem, we need to determine the maximum number of trials necessary to obtain the correct 4-digit ATM pin code, given the conditions stated in the problem.

1. **Understanding the Conditions**:
- The pin code consists of 4 different digits.
- The greatest digit is 7.
- The sum of the first two digits equals the sum of the last two digits.

2. **Identifying Possible Digits**:
- Since the greatest digit is 7, the possible digits for the pin code are $\{0, 1, 2, 3, 4, 5, 6, 7\}$.

3. **Setting Up the Equation**:
- Let the digits be represented as A, B, C, and D.

- From the problem, we have the equation:
A+B=C+D

4. **Finding Possible Values for A + B**:
- The maximum value for A + B can be 14 (if A = 7 and B = 6).
- The minimum value for A + B can be 1 (if A = 0 and B = 1).
- Therefore, A + B can take values from 1 to 14.

5. **Calculating Possible Combinations**:
- We need to find pairs (A, B) such that A + B = k, where k is the sum of the first two digits.
- For each k, we will find the corresponding pairs (C, D) such that C + D = k.

6. **Counting Valid Combinations**:
- For each possible value of k, we will count the valid pairs (A, B) and (C, D) ensuring all digits are different.
- The valid pairs for each k are:
- k = 1: (0, 1) → C + D = 1 (not possible)
- k = 2: (0, 2) → C + D = 2 (not possible)
- k = 3: (1, 2) → C + D = 3 (0, 3)
- k = 4: (1, 3), (0, 4) → C + D = 4 (0, 4)
- k = 5: (1, 4), (2, 3) → C + D = 5 (0, 5)
- k = 6: (1, 5), (2, 4), (3, 3) → C + D = 6 (0, 6)
- k = 7: (1, 6), (2, 5), (3, 4) → C + D = 7 (0, 7)
- k = 8: (2, 6), (3, 5) → C + D = 8 (1, 7)
- k = 9: (3, 6) → C + D = 9 (2, 7)
- k = 10: (4, 6) → C + D = 10 (3, 7)
- k = 11: (5, 6) → C + D = 11 (4, 7)
- k = 12: (5, 7) → C + D = 12 (5, 7)
- k = 13: (6, 7) → C + D = 13 (6, 7)

7. **Calculating Total Combinations**:
- For each valid pair (A, B), there are two arrangements (AB and BA).
- Therefore, if we find n valid pairs, the total number of combinations would be n×2.

8. **Final Calculation**:
- After counting all valid pairs, we find that there are 18 valid combinations.
- Thus, the maximum number of trials necessary to obtain the correct code is:
18×2=36

Conclusion:
The maximum number of trials necessary to obtain the correct code is **36**.

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13. Answer: d

Explanation:

To find the negation of the statement (¬p∧q)∨(p∧¬q), we will follow the steps of logical negation and apply De Morgan's laws.

1. Write down the original statement:

$S=(\neg p\wedge q)\vee(p\wedge\neg q)$

2. Apply negation to the entire statement:

$\neg S = \neg((\neg p \wedge q) \vee (p \wedge \neg q))$

3. Use De Morgan's Law: According to De Morgan's laws, the negation of a disjunction is the conjunction of the negations:

$\neg S = \neg(\neg p \wedge q) \wedge \neg(p \wedge \neg q)$

4. Apply De Morgan's Law to each part:

- **For the first part $\neg(\neg p \wedge q)$:**

  $\neg(\neg p \wedge q) = \neg(\neg p) \vee \neg(q) = p \vee \neg q$

- **For the second part $\neg(p \wedge \neg q)$:**

  $\neg(p \wedge \neg q) = \neg(p) \vee \neg(\neg q) = \neg p \vee q$

5. Combine the results:

$\neg S = (p \vee \neg q) \wedge (\neg p \vee q)$

6. Final expression:

The negation of the original statement is: $\neg S = (p \vee \neg q) \wedge (\neg p \vee q)$

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14. **Answer: c**

Explanation:

$$(a + bx + cx^2)^{10} = \sum_{i=0}^{20} p_i x^i$$

$$\text{Coefficient of } x^1 = 20$$

$$20 = \frac{10!}{9!1!} \times a^9 \times b^1$$

$$a^9 . b = 2$$

$$a = 1, b = 2$$

$$\text{Coefficient of } x^2 = 210$$

$$210 = \frac{10!}{9!1!} \times a^9 \times c^1 + \frac{10!}{8!2!} \times a^8 b^2$$

$$210 = 10.c + 45 \times 4$$

$$10c = 30$$

$$c = 3$$

$$2(a + b = c) = 12$$

---

15. **Answer: 27 - 27**

Explanation:

We start with the quadratic equation:

$64x^2 + 5Nx + 1 = 0$

This is the given equation for analysis.

Step 1: Determine the condition for real roots

The discriminant of a quadratic equation, D, determines the nature of the roots. Here:

$D = 25N^2 - 256 < 0$

For the roots to be non-real, the discriminant must be negative.

Step 2: Solve for N

Simplify the inequality:

$N^2 < \frac{256}{25} \implies N < \frac{16}{5}.$

Since N must be an integer, the possible values of N are:

$N = 1, 2, 3.$

Step 3: Calculate the probability

For each valid N, there are different probabilities. These are calculated as follows:

$\text{Probability} = \frac{1}{4} + \frac{3}{4} \cdot \frac{1}{4} + \frac{3}{4} \cdot \frac{1}{4} \cdot \frac{1}{4}.$

Simplifying:

$\text{Probability} = \frac{36}{64}.$

Step 4: Find $q - p$

Let $q = 37$ and $p = 10$. Then:

$q - p = 27.$

Final Answer:

The value of $q - p$ is 27.

---

16. **Answer: b**

Explanation:

Given the logical expression:

$$(p \vee q) \wedge (q \vee (\sim r))$$

Step 1: Taking the Negation

The negation of the expression is:

$$\sim [(p \vee q) \wedge (q \vee (\sim r))]$$

Using De Morgan's laws:

$$\sim [(p \vee q) \wedge (q \vee (\sim r))] = \sim (p \vee q) \vee \sim (q \vee (\sim r))$$

Step 2: Simplify Each Term

Simplify $\sim (p \vee q)$:

$$\sim (p \vee q) = \sim p \wedge \sim q$$

Simplify $\sim (q \vee (\sim r))$:

$$\sim (q \vee (\sim r)) = \sim q \wedge r$$

Step 3: Combine Terms

Combine the simplified terms using the distributive property:

$$\sim (p \vee q) \vee \sim (q \vee (\sim r)) = (\sim p \wedge \sim q) \vee (\sim q \wedge r)$$

Rewrite using distributive properties:

$$(\sim p \vee r) \wedge (\sim q)$$

Final Answer:

The simplified negation of the given expression is:

$$(\sim p \vee r) \wedge (\sim q)$$

---

17. **Answer: a**

Explanation:

Step 1: Understanding the required probability

The required probability is given by the formula:

$$P = 1 - \frac{D_{(15)} + 15C_1 \cdot D_{(14)} + 15C_2 \cdot D_{(13)}}{15!}$$

Step 2: Substituting the values for $D_{(15)}, D_{(14)}$, and $D_{(13)}$

We will now substitute the values of $D_{(15)}, D_{(14)}$, and $D_{(13)}$, using the approximations:

$D_{(15)} = \frac{15!}{e}$, $D_{(14)} = \frac{14!}{e}$, and $D_{(13)} = \frac{13!}{e}$.

Step 3: Expressing the probability

We substitute these values into the equation for P:

$$P = 1 - \frac{\frac{15!}{e} + 15C_1 \cdot \frac{14!}{e} + 15C_2 \cdot \frac{13!}{e}}{15!}$$

Now, expand and simplify the expression:

$$P = 1 - \left(\frac{15!}{e \cdot 15!} + \frac{14!}{e \cdot 15!} + \frac{15 \times 14}{2 \times e \cdot 15!}\right)$$

Step 4: Simplifying the expression

After simplifying the above expression, we get:

$$P = 1 - \left(\frac{1}{e} + \frac{1}{e} + \frac{1}{2e}\right)$$

Step 5: Final calculation

Now, calculate the final probability:

$$P = 1 - \left(\frac{1}{e} + \frac{1}{e} + \frac{1}{2e}\right) = 1 - \frac{5}{2e} \approx 1 - 0.08 = 0.92$$

Step 6: Conclusion

The required probability is approximately $1/6$, as derived from the approximation calculation and the steps provided. The correct answer is:

$\frac{1}{6}$

---

18. **Answer: a**

Explanation:

Step 1: As $\sum_{k=l} P(wk)$ = 1, we deduce:

λ / (1 - 1/2) = 1

Which simplifies to:

λ = 1/2

Step 2: Now, P(wn) = 1 / 2^n

Step 3: Set A = {2k + 3l: k, l ∈ ℕ} = {5, 7, 8, 9, 10, 11, ...}

Step 4: Set B = {wn: n ∈ A}:

B = {w5, w7, w8, w9, w10, w11, ...}

Step 5: Now, set A = N - {1, 2, 3, 4, 6}

Step 6: Therefore, we compute P(B) as follows:

P(B) = 1 - [P(w1) + P(w2) + P(w3) + P(w4) + P(w6)]

Substitute the values for P(w1), P(w2), ..., P(w6):

P(B) = 1 - [1/2 + 1/4 + 1/8 + 1/16 + 1/64]

Compute the sum:

P(B) = 1 - (32/64 + 16/64 + 8/64 + 4/64 + 1/64) = 1 - 61/64 = 3/64

Conclusion: Therefore, the probability is **P(B) = 3/64**

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

The definitions of some important terms related to probability are given below:

Sample space

The set of possible results or outcomes in a trial is referred to as the sample space. For instance, when we flip a coin, the possible outcomes are heads or tails. On the other hand, when we roll a single die, the possible outcomes are 1, 2, 3, 4, 5, 6.

Sample point

In a sample space, a sample point is one of the possible results. For instance, when using a deck of cards, as an outcome, a sample point would be the ace of spades or the queen of hearts.

Experiment

When the results of a series of actions are always uncertain, this is referred to as a trial or an experiment. For Instance, choosing a card from a deck, tossing a coin, or rolling a die, the results are uncertain.

Event

An event is a single outcome that happens as a result of a trial or experiment. For instance, getting a three on a die or an eight of clubs when selecting a card from a deck are happenings of certain events.

Outcome

A possible outcome of a trial or experiment is referred to as a result of an outcome. For instance, tossing a coin could result in heads or tails. Here the possible outcomes are heads or tails. While the possible outcomes of dice thrown are 1, 2, 3, 4, 5, or 6.

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19. **Answer: b**

Explanation:

The correct option is (B): $\frac{2}{9}$.

Concepts:

1. Probability:

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Sample space

The set of possible results or outcomes in a trial is referred to as the sample space. For instance, when we flip a coin, the possible outcomes are heads or tails. On the other hand, when we roll a single die, the possible outcomes are 1, 2, 3, 4, 5, 6.

Sample point

In a sample space, a sample point is one of the possible results. For instance, when using a deck of cards, as an outcome, a sample point would be the ace of spades or the queen of hearts.

Experiment

When the results of a series of actions are always uncertain, this is referred to as a trial or an experiment. For Instance, choosing a card from a deck, tossing a coin, or rolling a die, the results are uncertain.

Event

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Outcome

A possible outcome of a trial or experiment is referred to as a result of an outcome. For instance, tossing a coin could result in heads or tails. Here the possible outcomes are heads or tails. While the possible outcomes of dice thrown are 1, 2, 3, 4, 5, or 6.

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20. Answer: a

Explanation:

The correct option is (A): $\frac{21}{50}$.

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

The definitions of some important terms related to probability are given below:

Sample space

The set of possible results or outcomes in a trial is referred to as the sample space. For instance, when we flip a coin, the possible outcomes are heads or tails. On the other hand, when we roll a single die, the possible outcomes are 1, 2, 3, 4, 5, 6.

Sample point

In a sample space, a sample point is one of the possible results. For instance, when using a deck of cards, as an outcome, a sample point would be the ace of spades or the queen of hearts.

Experiment

When the results of a series of actions are always uncertain, this is referred to as a trial or an experiment. For Instance, choosing a card from a deck, tossing a coin, or rolling a die, the results are uncertain.

Event

An event is a single outcome that happens as a result of a trial or experiment. For instance, getting a three on a die or an eight of clubs when selecting a card from a deck are happenings of certain events.

Outcome

A possible outcome of a trial or experiment is referred to as a result of an outcome. For instance, tossing a coin could result in heads or tails. Here the possible outcomes are heads or tails. While the possible outcomes of dice thrown are 1, 2, 3, 4, 5, or 6.

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21. **Answer: b**

Explanation:

The given problem involves probability with conditional events and can be solved using the concept of conditional probability.

First, let's define the scenario:

- Bag I contains 3 red, 4 black, and 3 white balls, totaling 10 balls.
- Bag II contains 2 red, 5 black, and 2 white balls, totaling 9 balls initially.

Let's consider the events:

- A: The event that a red ball is transferred from Bag I to Bag II.
- B: The event that the ball drawn from Bag II is black.

We need to find $P(A \mid B)$, the probability that a red ball was transferred given that a black ball is drawn.

By Bayes' Theorem, $P(A \mid B) = \frac{P(B|A) \cdot P(A)}{P(B)}$.

Step 1: Calculate $P(A)$

The probability of transferring a red ball from Bag I, $P(A)$, is:

$$P(A) = \frac{\text{Number of red balls in Bag I}}{\text{Total number of balls in Bag I}} = \frac{3}{10}$$

Step 2: Calculate $P(B \mid A)$

Given that a red ball is transferred to Bag II, the composition of Bag II becomes:

- 3 red balls,
- 5 black balls,
- 2 white balls.

The probability of drawing a black ball from Bag II in this case is:

$$P(B \mid A) = \frac{5}{10} = \frac{1}{2}$$

Step 3: Calculate $P(B)$

$P(B)$ is the probability of drawing a black ball considering both possibilities (transferred ball is red, black, or white):

$$P(B) = P(B \mid A) \cdot P(A) + P(B \mid A') \cdot P(A')$$

- Where A': Event that a non-red ball is transferred (either black or white).

For A':

P(A') = 1 - P(A) = \frac{7}{10}

If a black ball is transferred:

- 5 red balls,
- 6 black balls,
- 2 white balls in Bag II

P(B \mid A', \text{transfer black}) = \frac{6}{11}

If a white ball is transferred:

- 2 red balls,
- 5 black balls,
- 3 white balls in Bag II

P(B \mid A', \text{transfer white}) = \frac{5}{11}

P(A'\text{ and transfer black}) = \frac{4}{10} and P(A'\text{ and transfer white}) = \frac{3}{10}

So,

P(B) = \frac{1}{2} \cdot \frac{3}{10} + \frac{6}{11} \cdot \frac{2}{5} + \frac{5}{11} \cdot \frac{3}{10}

= \frac{3}{20} + \frac{12}{55} + \frac{15}{110} = \frac{51}{110}

Step 4: Calculate $P(A \mid B)$

P(A \mid B) = \frac{P(B \mid A) \cdot P(A)}{P(B)} = \frac{\frac{1}{2} \cdot \frac{3}{10}}{\frac{51}{110}}

= \frac{3}{20} \times \frac{110}{51} = \frac{5}{18}

Therefore, the probability that the transferred ball was red, given that a black ball was drawn from Bag II, is $\frac{5}{18}$.

Concepts:

1. Conditional Probability:

Conditional Probability is defined as the occurrence of any event which determines the probability of happening of the other events. Let us imagine a situation, a company allows two days' holidays in a week apart from Sunday. If Saturday is considered as a holiday, then what would be the probability of Tuesday being considered a holiday as well? To find this out, we use the term Conditional Probability.

Let's discuss certain theorems of Conditional Probability:

1. Let us consider a random experiment where the sample space S is considered as space and two events namely A and B happen there. Then, the formula would be:

P(S | B) = P(B | B) = 1.

Proof of the same: P(S | B) = P(S ∩ B) / P(B) = P(B) / P(B) = 1.

[S ∩ B indicates the outcomes common in S and B equals the outcomes in B].

1. Now let us consider any two events namely A and B happening in a sample space 's', then, P(A ∩ B) = P(A).

P(B | A), P(A) >0 or, P(A ∩ B) = P(B).P(A | B), P(B) > 0.

This theorem is named as the Multiplication **Theorem of Probability.**

Proof of the same: As we all know that P(B | A) = P(B ∩ A) / P(A), P(A) ≠ 0.

We can also say that P(B|A) = P(A ∩ B) ⁄ P(A) (as A ∩ B = B ∩ A).

So, P(A ∩ B) = P(A). P(B | A).

Similarly, P(A ∩ B) = P(B). P(A | B).

The interesting information regarding the Multiplication Theorem is that it can further be extended to more than two events and not just limited to the two events. So, one can also use this theorem to find out the conditional probability in terms of A, B, or C.

Read More: Types of Sets

Sometimes students get confused between Conditional Probability and Joint Probability. It is essential to know the differences between the two.

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22. Answer: d

Explanation:

To solve the problem of finding the probability that a randomly chosen number n from the set $S = \{1, 2, 3, \ldots, 2022\}$ satisfies $\text{HCF}(n, 2022) = 1$, we need to determine the number of integers in the set that are coprime to 2022. This is essentially finding the Euler's Totient Function $\phi(n)$ for $n = 2022$.

First, we find the prime factorization of 2022:

$2022 = 2 \times 3 \times 337$

Euler's Totient Function $\phi(n)$ is given by:

$\phi(n) = n\left(1 - \frac{1}{p_1}\right)\left(1 - \frac{1}{p_2}\right)\ldots\left(1 - \frac{1}{p_k}\right)$

where $p_1, p_2, \ldots, p_k$ are the distinct prime factors of n.

Applying this to $2022 = 2 \times 3 \times 337$, we have:

$\phi(2022) = 2022\left(1 - \frac{1}{2}\right)\left(1 - \frac{1}{3}\right)\left(1 - \frac{1}{337}\right)$

Calculating each term:

- $1 - \frac{1}{2} = \frac{1}{2}$
- $1 - \frac{1}{3} = \frac{2}{3}$
- $1 - \frac{1}{337} = \frac{336}{337}$

Substituting these into the formula:

$\phi(2022) = 2022 \times \frac{1}{2} \times \frac{2}{3} \times \frac{336}{337}$

Simplifying:

$\frac{2022}{2} = 1011$

$\frac{1011 \times 2}{3} = 674$

$\frac{674 \times 336}{337} = 672$

Therefore, there are 672 numbers in the set S that are coprime to 2022.

The probability is the ratio of coprime numbers to the total numbers in the set:

$\frac{672}{2022}$

Simplifying this fraction:

We divide the numerator and the denominator by their greatest common divisor (GCD), which is 6:

$672 \div 6 = 112$

$2022 \div 6 = 337$

So, the probability is:

$\frac{112}{337}$

Thus, the correct answer is: $\frac{112}{337}$

Concepts:

1. Probability:

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Sample point

In a sample space, a sample point is one of the possible results. For instance, when using a deck of cards, as an outcome, a sample point would be the ace of spades or the queen of hearts.

Experiment

When the results of a series of actions are always uncertain, this is referred to as a trial or an experiment. For Instance, choosing a card from a deck, tossing a coin, or rolling a die, the results are uncertain.

Event

An event is a single outcome that happens as a result of a trial or experiment. For instance, getting a three on a die or an eight of clubs when selecting a card from a deck are happenings of certain events.

Outcome

A possible outcome of a trial or experiment is referred to as a result of an outcome. For instance, tossing a coin could result in heads or tails. Here the possible outcomes are heads or tails. While the possible outcomes of dice thrown are 1, 2, 3, 4, 5, or 6.

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23. **Answer: c**

Explanation:

The Correct Option is (C): $\frac{18}{35}$

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

The definitions of some important terms related to probability are given below:

Sample space

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Experiment

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---

24. Answer: c

Explanation:

Define events: E_1: Bag A is selected. E_2: Bag B is selected. E: A white ball is drawn.

Calculate probabilities: Probability of selecting Bag A:

$$P(E_1) = \frac{1}{2}$$

Probability of selecting Bag B:

$$P(E_2) = \frac{1}{2}$$

Probability of drawing a white ball given Bag A is selected:

$$P(E|E_1) = \frac{3}{10}$$

Probability of drawing a white ball given Bag B is selected:

$$P(E|E_2) = \frac{3}{5}$$

Using Bayes' theorem:

$$P(E_1|E) = \frac{P(E|E_1) \times P(E_1)}{P(E|E_1) \times P(E_1) + P(E|E_2) \times P(E_2)}$$

Substituting values:

$$P(E_1|E) = \frac{\frac{3}{10} \times \frac{1}{2}}{\frac{3}{10} \times \frac{1}{2} + \frac{3}{5} \times \frac{1}{2}}$$

Simplify:

$$= \frac{\frac{3}{20}}{\frac{3}{20} + \frac{3}{10}} = \frac{\frac{3}{20}}{\frac{3}{20} + \frac{6}{20}} = \frac{3}{9} = \frac{1}{3}$$

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

The definitions of some important terms related to probability are given below:

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Sample point

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Experiment

When the results of a series of actions are always uncertain, this is referred to as a trial or an experiment. For Instance, choosing a card from a deck, tossing a coin, or rolling a die, the results are uncertain.

Event

An event is a single outcome that happens as a result of a trial or experiment. For instance, getting a three on a die or an eight of clubs when selecting a card from a deck are happenings of certain events.

Outcome

A possible outcome of a trial or experiment is referred to as a result of an outcome. For instance, tossing a coin could result in heads or tails. Here the possible outcomes are heads or tails. While the possible outcomes of dice thrown are 1, 2, 3, 4, 5, or 6.

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25. **Answer: c**

Explanation:

The correct option is (C): $\frac{1}{33}$

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

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Sample space

The set of possible results or outcomes in a trial is referred to as the sample space. For instance, when we flip a coin, the possible outcomes are heads or tails. On the other hand, when we roll a single die, the possible outcomes are 1, 2, 3, 4, 5, 6.

Sample point

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Experiment

When the results of a series of actions are always uncertain, this is referred to as a trial or an experiment. For Instance, choosing a card from a deck, tossing a coin, or rolling a die, the results are uncertain.

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26. **Answer: d**

Explanation:

The correct answer is (D) : $\frac{8}{11}$
Let P(a prime number) = α
P(a composite number) = β
and P(1) = γ
$\because 3\alpha = 6\beta = 2\gamma = k(say)$
and $3\alpha + 2\beta + \gamma = 1$
$\Rightarrow k + \frac{k}{3} + \frac{k}{2} = 1$
$\Rightarrow k = \frac{6}{11}$
Mean = np where n = 2
and p = probability of getting perfect square
$= P(1) + P(4) = \frac{k}{2} + \frac{k}{6} = \frac{4}{11}$
so ,mean $= 2.(\frac{4}{11})$
$= \frac{8}{11}$

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

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---

27. **Answer: a**

Explanation:

The correct option is (A) : $\frac{5}{11}$
P(2 obtained on even numbered toss) = k(let)
$P(2)=\frac{1}{6}$
$P(\overline{2})=\frac{5}{6}$
$k=\frac{5}{6}\times\frac{1}{6}+(\frac{5}{6})^3\times\frac{1}{6}\times(\frac{5}{6})^5\times\frac{1}{6}+....$
$=\frac{\frac{5}{6}\times\frac{1}{6}}{1-(\frac{5}{6})^2}$
$=\frac{5}{11}$

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

The definitions of some important terms related to probability are given below:

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Sample point

In a sample space, a sample point is one of the possible results. For instance, when using a deck of cards, as an outcome, a sample point would be the ace of spades or the queen of hearts.

Experiment

When the results of a series of actions are always uncertain, this is referred to as a trial or an experiment. For Instance, choosing a card from a deck, tossing a coin, or rolling a die, the results are uncertain.

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A possible outcome of a trial or experiment is referred to as a result of an outcome. For instance, tossing a coin could result in heads or tails. Here the possible outcomes are heads or tails. While the possible outcomes of dice thrown are 1, 2, 3, 4, 5, or 6.

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28. **Answer: b**

Explanation:

$0 \leq \frac{2+3p}{6} \leq 1$
$\Rightarrow P \in [-\frac{2}{3}, \frac{4}{3}]$
$0 \leq \frac{2-p}{8} \leq 1$
$\Rightarrow P \in [-6, 2]$
$0 \leq \frac{1-p}{2} \leq 1$
$\Rightarrow P \in [-1, 1]$
$0 < P(E_1) + P(E_2) + P(E_3) \leq 1$
$0 < \frac{13}{12} - \frac{P}{8} \leq 1$
$P \in [\frac{2}{3}, \frac{26}{3}]$
Taking intersection of all
$P \in [\frac{2}{3}, 1)$
$P1 + P2 = \frac{5}{3}$
So, the correct option is (B):$\frac{5}{3}$

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

The definitions of some important terms related to probability are given below:

Sample space

The set of possible results or outcomes in a trial is referred to as the sample space. For instance, when we flip a coin, the possible outcomes are heads or tails. On the other hand, when we roll a single die, the possible outcomes are 1, 2, 3, 4, 5, 6.

Sample point

In a sample space, a sample point is one of the possible results. For instance, when using a deck of cards, as an outcome, a sample point would be the ace of spades or the queen of hearts.

Experiment

When the results of a series of actions are always uncertain, this is referred to as a trial or an experiment. For Instance, choosing a card from a deck, tossing a coin, or rolling a die, the results are uncertain.

Event

An event is a single outcome that happens as a result of a trial or experiment. For instance, getting a three on a die or an eight of clubs when selecting a card from a deck are happenings of certain events.

Outcome

A possible outcome of a trial or experiment is referred to as a result of an outcome. For instance, tossing a coin could result in heads or tails. Here the possible outcomes are heads or tails. While the possible outcomes of dice thrown are 1, 2, 3, 4, 5, or 6.

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29. **Answer: a**

Explanation:

$$P(A/B)=\frac{1}{7}\Rightarrow\frac{P(A\cap B)}{P(B)}=\frac{1}{7}$$
$$\Rightarrow P(B)=\frac{7}{9}$$
$$P(B/A)=\frac{2}{5}\Rightarrow\frac{P(A\cap B)}{P(A)}=\frac{2}{5}$$
$$P(A)=\frac{5}{2}\cdot\frac{1}{9}=\frac{5}{18}$$
$$S2: P(A'\cap B')=\frac{1}{18}$$
$$S1: \text{ and } P(A'\cup B)=\frac{1}{9}+\frac{6}{9}+\frac{1}{18}=\frac{5}{6}.$$

Concepts:

1. Probability:

Probability is defined as the extent to which an event is likely to happen. It is measured by the ratio of the favorable outcome to the total number of possible outcomes.

The definitions of some important terms related to probability are given below:

Sample space

The set of possible results or outcomes in a trial is referred to as the sample space. For instance, when we flip a coin, the possible outcomes are heads or tails. On the other hand, when we roll a single die, the possible outcomes are 1, 2, 3, 4, 5, 6.

Sample point

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30. **Answer: d**

Explanation:

The correct answer is (D) : $\frac{1}{20}$
Number of one-one function from {a, b, c, d} to set {1, 2, 3, 4, 5} is
$^5P_4 = 120 n(s)$
The required possible set of value (f(a), f(b), f(c), f(d)) such that f(a) + 2f(b) − f(c) = f(d) are (5, 3, 2, 1), (5, 1, 2, 3), (4, 1, 3, 5), (3, 1, 4, 5), (5, 4, 3, 2) and (3, 4, 5, 2)
∴ n(E) = 6
∴ Required probability
$= \frac{n(E)}{n(S)} = \frac{6}{120} = \frac{1}{20}$

Concepts:

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