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HIGHER MATHS
PROBABILITY

1. A bag contains 2 yellow, 3 green and 2 blue balls. Two balls are drawn at random. What is the probability that none of the balls drawn is blue?

A. $\frac{10}{21}$

B. $\frac{9}{11}$

C. $\frac{1}{2}$

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

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Answer: Option A

Explanation:

Total number of balls $= 2 + 3 + 2 = 7$

Let S be the sample space.
n(S) = Total number of ways of drawing 2 balls out of $7 = {}^7C_2$

Let E = Event of drawing 2 balls, none of them is blue.

n(E) = Number of ways of drawing 2 balls , none of them is blue
= Number of ways of drawing 2 balls from the total 5 $(= 7 - 2)$ balls $= {}^5C_2$
($\because$ There are two blue balls in the total seven balls. Total number of non-blue balls $= 7 - 2 = 5$)

$$P(E) = \frac{n(E)}{n(S)} = \frac{{}^5C_2}{{}^7C_2}$$

$$= \frac{\left(\frac{5 \times 4}{2 \times 1}\right)}{\left(\frac{7 \times 6}{2 \times 1}\right)} = \frac{10}{21}$$

2. A die is rolled twice. What is the probability of getting a sum equal to 9?

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

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

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

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

Answer: Option C

Explanation:

Total number of outcomes possible when a die is rolled $= 6$ ($\because$ any one face out of the 6 faces)

Hence, total number of outcomes possible when a die is rolled twice, $n(S) = 6 \times 6 = 36$

E = Getting a sum of 9 when the two dice fall $= \{(3,6),(4,5),(5,4),(6,3)\}$

Hence, $n(E) = 4$

$$P(E) = \frac{n(E)}{n(S)} = \frac{4}{36} = \frac{1}{9}$$

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3. What is the probability of getting a number less than 4 when a die is rolled?

A. $\frac{1}{2}$

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

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

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

Answer: Option A

Explanation:

Total number of outcomes possible when a die is rolled $= 6$ ($\because$ any one face out of the 6 faces)
i.e., $n(S) = 6$

E = Getting a number less than $4 = \{1, 2, 3\}$
Hence, $n(E) = 3$

$$P(E) = \frac{n(E)}{n(S)} = \frac{3}{6} = \frac{1}{2}$$

4. One card is randomly drawn from a pack of 52 cards. What is the probability that the card drawn is a face card(Jack, Queen or King)

A. $\frac{1}{13}$

B. $\frac{3}{13}$

C. $\frac{4}{13}$

D. $\frac{2}{13}$

Answer: Option B

Explanation:

Total number of cards, $n(S) = 52$

Total number of face cards, $n(E) = 12$

$$P(E) = \frac{n(E)}{n(S)} = \frac{12}{52} = \frac{3}{13}$$

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5. . A dice is thrown. What is the probability that the number shown in the dice is divisible by 3?

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

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

C. $\frac{1}{2}$

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

Answer: Option B

Explanation:

Total number of outcomes possible when a dice is rolled, $n(S) = 6$
$(\because 1, 2, 3, 4, 5 \text{ or } 6)$

E = Event that the number shown in the dice is divisible by $3 = \{3, 6\}$
Hence, $n(E) = 2$

$$P(E) = \frac{n(E)}{n(S)} = \frac{2}{6} = \frac{1}{3}$$

6.

There are 15 boys and 10 girls in a class. If three students are selected at random, what is the probability that 1 girl and 2 boys are selected?

A. $\frac{21}{46}$

B. $\frac{1}{2}$

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

D. $\frac{7}{42}$

Answer: Option A

Explanation:

Let S be the sample space.

n(S) = Total number of ways of selecting 3 students from 25 students $= {}^{25}C_3$

Let E = Event of selecting 1 girl and 2 boys.
n(E) = Number of ways of selecting 1 girl and 2 boys

15 boys and 10 girls are there in the class. We need to select 2 boys from 15 boys and 1 girl from 10 girls. Number of ways in which this can be done
$= {}^{15}C_2 \times {}^{10}C_1$
i.e., $n(E) = {}^{15}C_2 \times {}^{10}C_1$

$$P(E) = \frac{n(E)}{n(S)} = \frac{{}^{15}C_2 \times {}^{10}C_1}{{}^{25}C_3}$$

$$= \frac{\left(\frac{15 \times 14}{2 \times 1}\right) \times 10}{\left(\frac{25 \times 24 \times 23}{3 \times 2 \times 1}\right)} = \frac{21}{46}$$

7. 3 balls are drawn randomly from a bag contains 3 black, 5 red and 4 blue balls. What is the probability that the balls drawn contain balls of different colors?

A. $\frac{3}{11}$ B. $\frac{1}{3}$

C. $\frac{1}{2}$ D. $\frac{2}{11}$

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Answer: Option A

Explanation:

Total number of balls $= 3 + 5 + 4 = 12$

Let S be the sample space.
n(S) = Total number of ways of drawing 3 balls out of 12 $= {}^{12}C_3$

Let E = Event of drawing 3 different coloured balls.

To get 3 different coloured balls, we need to select one black ball from 3 black balls, one red ball from 5 red balls, one blue ball from 4 blue balls. Number of ways in which this can be done $= {}^{3}C_1 \times {}^{5}C_1 \times {}^{4}C_1$
i.e., n(E) = ${}^{3}C_1 \times {}^{5}C_1 \times {}^{4}C_1$

$$P(E) = \frac{n(E)}{n(S)} = \frac{{}^{3}C_1 \times {}^{5}C_1 \times {}^{4}C_1}{{}^{12}C_3}$$
$$= \frac{3 \times 5 \times 4}{\left(\frac{12 \times 11 \times 10}{3 \times 2 \times 1}\right)} = \frac{3}{11}$$

8.

5 coins are tossed together. What is the probability of getting exactly 2 heads?

A. $\frac{1}{2}$

B. $\frac{7}{16}$

C. $\frac{5}{16}$

D. $\frac{4}{11}$

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Answer: Option C

Explanation:

Total number of outcomes possible when a coin is tossed $= 2$ ($\because$ Head or Tail)
Hence, total number of outcomes possible when 5 coins are tossed, $n(S) = 2^5$

E = Event of getting exactly 2 heads when 5 coins are tossed.
n(E) = Number of ways of getting exactly 2 heads when 5 coins are tossed $= {}^5C_2$

$$P(E) = \frac{n(E)}{n(S)} = \frac{{}^5C_2}{2^5} = \frac{5}{16}$$

9. A card is randomly drawn from a deck of 52 cards. What is the probability getting an Ace or King or Queen?

A. $\frac{1}{2}$

B. $\frac{2}{13}$

C. $\frac{3}{13}$

D. $\frac{1}{13}$

Answer: Option C

Explanation:

Total number of cards $= 52$

Total number of Ace cards $= 4$

$P(\text{Ace}) = \frac{4}{52} = \frac{1}{13}$

Total number of King cards $= 4$

$P(\text{King}) = \frac{4}{52} = \frac{1}{13}$

Total number of Queen cards $= 4$

$P(\text{Queen}) = \frac{4}{52} = \frac{1}{13}$

Here, clearly the events of getting an Ace, King and Queen are mutually exclusive. By addition rule, we have

P(Ace or King or Queen) = P (Ace) + P (King)+ P(Queen)

$= \frac{1}{13} + \frac{1}{13} + \frac{1}{13} = \frac{3}{13}$

10. The probability A getting a job is $\frac{1}{5}$ and that of B is $\frac{1}{7}$. What is the probability that only one of them gets a job?

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

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

C. $\frac{11}{35}$

D. $\frac{12}{35}$

Answer: Option B

Explanation:

Let A be the event that A gets a job and B be the event that B gets a job

Given that $P(A) = \frac{1}{5}$ and $P(B) = \frac{1}{7}$

Probability that only one of them gets a job

$= P\left[(A \cap \bar{B}) \cup (B \cap \bar{A})\right]$

$= P(A \cap \bar{B}) + P(B \cap \bar{A})$

$= P(A)P(\bar{B}) + P(B)P(\bar{A})$

rule)

$= P(A)[1 - P(B)] + P(B)[1 - P(A)]$

$= \frac{1}{5}\left(1 - \frac{1}{7}\right) + \frac{1}{7}\left(1 - \frac{1}{5}\right)$

$= \frac{1}{5} \times \frac{6}{7} + \frac{1}{7} \times \frac{4}{5} = \frac{6}{35} + \frac{4}{35} = \frac{2}{7}$

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11. A letter is chosen at random from the word 'ASSASSINATION'. What is the probability that it is a vowel?

A. $\frac{8}{13}$

B. $\frac{6}{13}$

C. $\frac{4}{13}$

D. $\frac{7}{13}$

Answer: Option B

Explanation:

Total number of letters in the word ASSASSINATION, $n(S) = 13$

Total number of vowels in the word ASSASSINATION, $n(E) = 6 \quad (\because 3\text{ 'A'}, 2\text{ 'I'}, 1\text{ 'O'})$

Probability for getting a vowel, $P(E) = \frac{n(E)}{n(S)} = \frac{6}{13}$

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12.

One ball is picked up randomly from a bag containing 8 yellow, 7 blue and 6 black balls. What is the probability that it is neither yellow nor black?

A. $\frac{1}{2}$ B. $\frac{1}{4}$

C. $\frac{1}{3}$ D. $\frac{3}{4}$

Answer: Option C

Explanation:

Total number of balls, n(S) $= 8 + 7 + 6 = 21$

n(E) = Number of ways in which a ball can be selected which is neither yellow nor black
$= 7$ $\quad$ ($\because$ there are only 7 balls which are neither yellow nor black)

$$P(E) = \frac{n(E)}{n(S)} = \frac{7}{21} = \frac{1}{3}$$

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13. Two cards are drawn together from a pack of 52 cards. The probability that one is a club and one is a diamond?

A. $\frac{1}{52}$

B. $\frac{1}{26}$

C. $\frac{13}{102}$

D. $\frac{13}{51}$

Answer: Option C

Explanation:

n(S) = Total number of ways of drawing 2 cards from 52 cards $= {}^{52}C_2$

Let E be event of getting 1 club and 1 diamond. We know that there are 13 clubs and 13 diamonds in the total 52 cards.

Hence, n(E) = Number of ways of drawing one club from 13 and one diamond from 13 $= {}^{13}C_1 \times {}^{13}C_1$

$$P(E) = \frac{n(E)}{n(S)} = \frac{{}^{13}C_1 \times {}^{13}C_1}{{}^{52}C_2}$$
$$= \frac{13 \times 13}{\left(\frac{52 \times 51}{2}\right)} = \frac{13}{102}$$

14.

Two cards are drawn together at random from a pack of 52cards. What is the probability of both the cards being Queens?

A. $\frac{1}{221}$

B. $\frac{1}{52}$

C. $\frac{1}{26}$

D. $\frac{2}{221}$

Answer: Option A

Explanation:

This problem can be solved using the concept of conditional probability.

Let A be the event of getting a Queen in the first draw.

Total number of Queens $= 4$
Total number of cards $= 52$
P(Queen in first draw) $= \frac{4}{52}$

Assume that the first event has happened. i.e., a Queen has already been drawn in the first draw. Let B be event of getting a Queen in the second draw.

Since 1 Queen is drawn in the first draw, total number of Queens remaining $= 3$
Since 1 Queen is drawn in the first draw, total number of cards remaining $= 52 - 1 = 51$
P(Queen in second draw) $= \frac{3}{51}$

P(Queen in first draw and Queen in second draw)
= P(Queen in first draw) × P(Queen in second draw)
$= \frac{4}{52} \times \frac{3}{51} = \frac{1}{13} \times \frac{1}{17} = \frac{1}{221}$

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15.

A letter is chosen at random from the word 'ASSASSINATION'. What is the probability that it is a consonant?

A. $\frac{8}{13}$

B. $\frac{4}{13}$

C. $\frac{6}{13}$

D. $\frac{7}{13}$

Answer: Option D

Explanation:

Total Number of letters in the word ASSASSINATION, $n(S) = 13$

Total number of consonants in the word ASSASSINATION $= 7$

$$P(\text{consonant}) = \frac{7}{13}$$

16. Six dice are tossed together. What is the probability of getting the same face in all the dice?

A. $\frac{1}{6^6}$

B. $\frac{17}{6^5}$

C. $\frac{7}{6^4}$

D. $\frac{1}{6^5}$

Answer: Option D

Explanation:

Total number of outcomes possible when a die is tossed $= 6 \quad (\because$ any of the 6 faces)

Hence, total number of outcomes possible when 6 dice are thrown, n(S)$= 6^6$

n(E) = Number of ways of getting same face in all the dice $= {}^6C_1 = 6$

$$P(E) = \frac{n(E)}{n(S)} = \frac{6}{6^6} = \frac{1}{6^5}$$

17.

Six dice are tossed together. What is the probability of getting different faces in all of the dice?

A. $\frac{1}{6^6}$

B. $\frac{6!}{6^6}$

C. $\frac{1}{6^5}$

D. $\frac{6!}{6^5}$

Answer: Option B

Explanation:

Total number of outcomes possible when a die is tossed $= 6$ $\quad (\because$ any of the 6 faces)

Hence, total number of outcomes possible when 6 dice are thrown, $n(S) = 6^6$

n(E) = Number of ways of getting different faces in all the dice
= Number of arrangements of 6 numbers $1, 2, 3, 4, 5, 6$ by taking all at a time (without repeating any number)
$= 6!$

$$P(E) = \frac{n(E)}{n(S)} = \frac{6!}{6^6}$$

18.

Six persons enter a lift on the ground floor of a nine floor apartment. Assuming that each of them independently and with equal probability can leave the lift at any floor beginning with the first, what is the probability that all the six persons are leaving the lift at different floors?

A. $\frac{8!}{8^6}$

B. $\frac{8!}{8^7}$

C. $\frac{{}^8C_6}{8^6}$

D. $\frac{{}^8P_6}{8^6}$

Answer: Option D

Explanation:

Apart from the ground floor, there are 8 floors. Let's find out the total number of ways in which all the six persons can leave the lift at eight different floors

1^{st} person can leave the lift in any of the 8 floors (8 ways).
2^{nd} person can leave the lift in any of the remaining 7 floors (7 ways).
3^{rd} person can leave the lift in any of the remaining 6 floors (6 ways).
...
6^{th} person can leave the lift in any of the remaining 3 floors (3 ways).

Total number of ways $= 8 \times 7 \times 6 \times 5 \times 4 \times 3 = {}^{8}P_{6}$

(In fact, from the definition of permutations itself, we must be able to directly say that the number of ways in which all the six persons can leave the lift at 8 different floors is ${}^{8}P_{6}$)

i.e., n(E) = Total number of ways in which all the six persons can leave the lift at eight different floors $= {}^{8}P_{6}$

Now we will find out the total number of ways in which each of the six persons can leave the lift at any of the eight floors.

1^{st} person can leave the lift in any of the 8 floors (8 ways).

2^{nd} person can leave the lift in any of the 8 floors (8 ways).

3^{rd} person can leave the lift in any of the 8 floors (8 ways).

...

6^{th} person can leave the lift in any of the 8 floors (8 ways).

Total number of ways $= 8 \times 8 \times 8 \times 8 \times 8 \times 8 = 8^6$

i.e., n(S) = Total number of ways in which each the six persons can leave the lift at any of the eight floors $= 8^6$

$$P(E) = \frac{n(E)}{n(S)} = \frac{{}^8P_6}{8^6}$$

19

A basket contains 15 apples and 10 oranges out of which 4 apples and 2 oranges are defective. If a person takes two fruits at random, what is the probability that either both are apples or both are good

A. $\frac{221}{300}$

B. $\frac{312}{401}$

C. None of these

D. $\frac{1}{2}$

Answer: Option A

Explanation:

Number of ways in which two fruits can be taken from 25 fruits $= {}^{25}C_2$ $(\because$ total fruits $= 15 + 10 = 25)$

Number of ways in which two apples can be taken from 15 apples $= {}^{15}C_2$

P(both are apples) $= \dfrac{{}^{15}C_2}{{}^{25}C_2}$

Number of ways in which two fruits taken can be taken from 19 good fruits $= {}^{19}C_2$
$(\because$ total good fruits $= (15 + 10) - (4 + 2) = 19)$

P(both are good) $= \dfrac{{}^{19}C_2}{{}^{25}C_2}$

There are 11 good apples. Number of ways in which two apples can be taken from these 11 good apples $= {}^{11}C_2$

P(both are apples and both are good) $= \dfrac{{}^{11}C_2}{{}^{25}C_2}$

P(both are apples or both are good)
= P(both are apples)+ P(both are good) - P(both are apples and both are good)
(Reference: addition rule)

$$\frac{{}^{15}C_2}{{}^{25}C_2} + \frac{{}^{19}C_2}{{}^{25}C_2} - \frac{{}^{11}C_2}{{}^{25}C_2}$$

$$= \frac{\dfrac{15 \times 14}{2 \times 1} + \dfrac{19 \times 18}{2 \times 1} - \dfrac{11 \times 10}{2 \times 1}}{\dfrac{25 \times 24}{2 \times 1}}$$

$$= \frac{221}{300}$$

20.

Three boys P,Q and R are to speak at a function along with 5 others. If all of them speak in random order, what is the probability that P speaks before Q and Q speaks before R?

A. $\frac{1}{3}$ B. $\frac{1}{9}$

C. $\frac{1}{6}$ D. $\frac{2}{9}$

Answer: Option C

Explanation:

n(S) = Total number of ways in which 8 boys can speak $= 8!$

Now, let's find out the total number of ways in which 8 boys can speak where P speaks before Q and Q speaks before R.

Let the 8 boys be A, B, C, D, E, P, Q, R. There are 8 positions to be filled.

Number of options for $A = 8$ (any of the 8 positions).
Number of options for $B = 7$ (any of the 7 positions).
Number of options for $C = 6$ (any of the 6 positions).
Number of options for $D = 5$ (any of the 5 positions).
Number of options for $E = 4$ (any of the 4 positions).
Since P must speak before Q, and Q must speak before R, the 3 remaining positions must be occupied as P-Q-R. i.e, there is only 1 way of doing this.

Total number of ways $= 8 \times 7 \times 6 \times 5 \times 4$
i.e., n(E) = Total number of ways in which 8 boys can speak where P speaks before Q and Q speaks before R
$= 8 \times 7 \times 6 \times 5 \times 4$

$$P(E) = \frac{n(E)}{n(S)} = \frac{8 \times 7 \times 6 \times 5 \times 4}{8!} = \frac{1}{6}$$