

Permutations And Combinations JEE Main PYQ - 1

Total Time: 25 Minute

Total Marks: 40

Instructions

Instructions

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.

Permutations And Combinations

1. The number of natural numbers less than 7,000 which can be formed by using the digits 0, 1, 3, 7, 9 (repetition of digits allowed) is equal to :

(+4, -1)

[29-Jul-2022-Shift-2]

- a. 250
- b. 374
- c. 372
- d. 375

2. The number of numbers between 2,000 and 5,000 that can be formed with the digits 0, 1, 2, 3, 4 (repetition of digits is not allowed) and are multiple of 3 is :

(+4, -1)

[Jan. 09, 2019 (II)]

- a. 24
- b. 30
- c. 36
- d. 48

3. The number of integers greater than 6,000 that can be formed using the digits 3, 5, 6, 7 and 8 without repetition is

(+4, -1)

[2015]

- a. 216
- b. 192
- c. 120
- d. 72

4. The number of 9 digit numbers, that can be formed using all the digits of the number 123412341 so that the even digits occupy only even places, is

(+4, -1)

[24-Jan-2023 Shift 1]

5. The number of integers, greater than 7000 that can be formed, using the digits 3, 5, 6, 7, 8 without repetition, is (+4, -1)
[24-Jan-2023 Shift 2]
- a. 168
b. 120
c. 220
d. 48
-
6. The number of numbers, strictly between 5000 and 10000 can be formed using the digits 1, 3, 5, 7, 9 without repetition, is (+4, -1)
[25-Jan-2023 Shift 2]
- a. 72
b. 120
c. 6
d. 12
-
7. Consider the word INDEPENDENCE. The number of words such that all the vowels are together is? (+4, -1)
[8-Apr-2023 shift 1]
- a. 16800
b. 15800
c. 17900
d. 14800
-
8. 7 boys and 5 girls are to be seated around a circular table such that no two girls sit together is? (+4, -1)
[10-Apr-2023 shift 1]
- a. $126(5!)^2$
b. $720(5!)$

c. $720(6!)$

d. 720

9. The total number of six digit numbers, formed using the digits 4, 5, 9 only and divisible by 6, is __ (+4, -1)

10. If ${}^{2n+1}P_{n-1} : {}^{2n-1}P_n = 11 : 21$, then $n^2 + n + 15$ is equal to : (+4, -1)

[29-Jan-2024 Shift 2]



Answers

1. Answer: b

Explanation:

$$\text{Number of numbers} = 2 \times 5^3$$

$$\begin{aligned}\text{Required number} &= 5^3 + 2 \times 5^3 - 1 \\ &= 374\end{aligned}$$

Concepts:

1. Permutations:

A **permutation** is an arrangement of multiple objects in a particular order taken a few or all at a time. The formula for permutation is as follows:

$${}^n P_r = \frac{n!}{(n-r)!}$$

${}^n P_r$ = permutation

n = total number of objects

r = number of objects selected

Types of Permutation

- Permutation of n different things where repeating is not allowed
- Permutation of n different things where repeating is allowed
- Permutation of similar kinds or duplicate objects

2. Answer: b

Explanation:

Number between 2,000 and 5,000 is 4 digits number.

Using 0, 1, 2, 3, 4 (repetition of digits is not allowed) and are multiple of 3.

For multiple of 3, the sum of all digits should be divisible by 3

So, number can be formed 0, 1, 2, 3 (sum is 6 which is divisible by 3) or 0, 2, 3, 4 (sum is 9 which is divisible 1 cannot be on highest digit in the number).

Therefore, number of 4 digit numbers = $2 \times 3! + 3 \times 3! = 30$

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3. Answer: b

Explanation:

$$6/7/8 \text{ --- } \downarrow 3 \times {}^4 C_3 \times 3! = 72 \text{ --- } = 120 \text{ Total} = 192$$

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4. Answer: 60 – 60

Explanation:

The correct answer is 60

Even digits occupy at even places

$$\frac{4!}{2!2!} \times \frac{5!}{2!3!} = \frac{24 \times 120}{4 \times 12} = 60$$

Concepts:

1. Permutations and Combinations:

Permutation:

Permutation is the method or the act of arranging members of a set into an order or a sequence.

- In the process of rearranging the numbers, subsets of sets are created to determine all possible arrangement sequences of a single data point.
- A permutation is used in many events of daily life. It is used for a list of data where the data order matters.

Combination:

Combination is the method of forming subsets by selecting data from a larger set in a way that the selection order does not matter.

- Combination refers to the combination of about n things taken k at a time without any repetition.
 - The combination is used for a group of data where the order of data does not matter.
-

5. Answer: a

Explanation:

The correct answer is (A) : 168

Four digit numbers greater than 7000

$$= 2 \times 4 \times 3 \times 2 = 48$$

Five digit number = $5! = 120$

Total number greater than 7000

$$= 120 + 48 = 168$$

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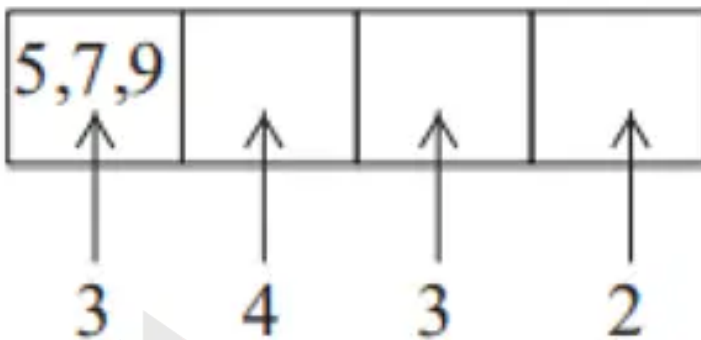
6. Answer: a

Explanation:

The correct answer is (A) : 72

Numbers between 5000&10000

Using digits 1,3,5,7,9



$$\text{Total Numbers} = 3 \times 4 \times 3 \times 2 = 72$$

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7. Answer: a

Explanation:

The correct answer is (A) : 16800

The word has 12 letters, out of which 5 are vowels and 7 are consonants.

Because we need to keep the vowels together always, we can consider the 5 vowels as one letter.

So, the number of ways of arranging the consonants is given by, $\frac{8!}{3! \times 2!}$

On expanding the factorial, we get , $\frac{8 \times 7 \times 6 \times 5 \times 4 \times 3!}{3! \times 2!}$

On simplification, $\frac{8 \times 7 \times 6 \times 5 \times 4}{2}$

=3360

So the vowels can also be rearranged themselves. Out of the 5 vowels, 4 are the same.

So, the ways of arranging the vowels is given by $\frac{5!}{4!}$

After simplification, we get, $\frac{5 \times 4!}{4!} = 5$

Therefore, the vowels can be arranged in 5 ways.

The number of words that can be formed such that vowels are always together is given by the product of the number of ways of arranging the letters with all the vowels together and the number of ways of arranging the vowels.

$\Rightarrow 5 \times 3360 = 16800$

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- A permutation is used in many events of daily life. It is used for a list of data where the data order matters.

Combination:

Combination is the method of forming subsets by selecting data from a larger set in a way that the selection order does not matter.

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8. Answer: a

Explanation:

The correct answer is (A) :

First, we need to find the total number of ways to seat all 12 people around the circular table, which is $(12-1)! = 11!$ since we can fix one person's position as a reference.

Next, we need to subtract the number of ways that two or more girls sit together. We can approach this by treating the five girls as a block and permuting them first, which can be done in $5!$ ways.

Then we can insert this block of girls in the 8 spaces between the 7 boys or at the beginning or end of the line of boys, which gives us 9 positions to place the block of girls. Once the block of girls is placed, we can permute the 7 boys in $7!$ ways.

Therefore, the total number of ways that two or more girls sit together is $5! \times 9 \times 7!$

\therefore the number of ways that no two girls sit together is $11! - 5! \times 9 \times 7! = 126(5!)^2$.

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9. Answer: 81 - 81

Explanation:

The correct answer is 81

Taking single digit $\rightarrow 444444$ $\frac{6!}{6!} = 1$

Taking two digit \rightarrow

$(4, 5)$ 444555 $(4, 9)$ 444999

$$\frac{5!}{3!2!} = 10$$

$$\frac{5!}{3!2!} = 10$$

Taking three digit

$$4, 5, 9, 4, 4, 4 \Rightarrow \frac{5!}{3!} = 20$$

$$4, 5, 9, 5, 5, 5 \Rightarrow \frac{5!}{4!} = 5$$

$$4, 5, 9, 9, 9, 9 \Rightarrow \frac{5!}{4!} = 5$$

$$4, 5, 9, 4, 5, 9 \Rightarrow \frac{5!}{2!2!} = 30$$

$$\text{Total} = 81$$

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10. Answer: 45 – 45

Explanation:

The correct answer is 45.

$$\frac{(2n+1)(n-1)!}{(n+2)!(2n-1)!} = \frac{11}{21}$$

$$\Rightarrow \frac{(2n+1)(2n)}{(n+2)(n+1)n} = \frac{11}{21}$$

$$\Rightarrow \frac{2n+1}{(n+1)(n+2)} = \frac{11}{42}$$

$$\Rightarrow n = 5$$

$$\Rightarrow n^2 + n + 15$$

$$= 25 + 5 + 15 = 45$$

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