Permutations And Combinations JEE Main PYQ - 2

Total Time: 25 Minute   **Total Marks:** 40

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.

Permutations And Combinations

1. Let T_n be the number of all possible triangles formed by joining vertices of an n-sided regular polygon. If $T_{n+1} - T_n = 10$ then the value of n is   **(+4, −1)**

    a. 7

    b. 5

    c. 10

    d. 8

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2. Let A and B be two sets containing four and two elements respectively. Then the number of subsets of the set $A \times B$, each having at least three elements is :   **(+4, −1)**

    a. 219

    b. 256

    c. 275

    d. 510

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3. If all the words (with or without meaning) having five letters, formed using the letters of the word $SMALL$ and arranged as in a dictionary; then the position of the word $SMALL$ is: **(+4, −1)**

    a. 46th

    b. 59th

    c. 52th

    d. 58th

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4. All possible numbers are formed using the digits $1, 1, 2, 2, 2, 2, 3, 4, 4$ taken all at a time. The number of such numbers in which the odd digits occupy even   **(+4, −1)**

places is :

a. 175

b. 162

c. 160

d. 180

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5. An eight digit number divisible by 9 is to be formed using digits from 0 to 9 without repeating the digits. The number of ways in which this can be done is : **(+4, −1)**

a. 72 (7!)

b. 18 (7!)

c. 40 (7!)

d. 36 (7!)

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6. If a, b and c are the greatest values of $^{19}C_p$, $^{20}C_q$ and $^{21}C_r$ respectively, then : **(+4, −1)**

a. $\frac{a}{11} = \frac{b}{22} = \frac{c}{42}$

b. $\frac{a}{10} = \frac{b}{11} = \frac{c}{42}$

c. $\frac{a}{11} = \frac{b}{22} = \frac{c}{21}$

d. $\frac{a}{10} = \frac{b}{11} = \frac{c}{21}$

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7. Consider a class of 5 girls and 7 boys. The number of different teams consisting of 2 girls and 3 boys that can be formed from this class, if there are two specific boys A and B, who refuse to be the members of the same team, is : **(+4, −1)**

a. 200

b. 300

c. 500

d. 350

8. Consider three boxes, each containing 10 balls labelled $1, 2, ..., 10$. Suppose   (+4, –1)
one ball is randomly drawn from each of the boxes. Denote by n_i, the label of
the ball drawn from the ith box, $(i = 1, 2, 3)$. Then, the number of ways in which
the balls can be chosen such that $n_1 < n_2 < n_3$ is :

a. 82

b. 240

c. 164

d. 120

9. If $^{2n}C_3 : {}^nC_3 = 10$, then $\frac{n^2+3n}{n^2-3n+4}$ is equal to   (+4, –1)

10. Find all the four letter words with two vowels and 2 consonants from the word   (+4,
UNIVERSE?   –1)

Answers

1. Answer: b

Explanation:

Given , $T_n = \,^nC_3 \, \Rightarrow \, T_{n+1} = \,^{n+1}C_3$

$\therefore \ T_{n+1} - T_n = \,^{n+1}C_3 - \,^nC_3 = 10 \,\,\,\,\,\,\,\,\,\,\, [given]$

$\Rightarrow \,^nC_2 + \,^n C_3 - \,^nC_3 = 10 \,\,\,\,\,\,\, [\because \,^nC_r \, + \,^nC_{r+1} = \,^{n+1}C_{r+1}]$

$\Rightarrow \,^nC_2 = 10$

$\Rightarrow n = 5$

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.
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2. Answer: a

Explanation:

$n(A \times B) = 8$

Total subsets $= 2^8$

$^8C_0 + 8C_1 + {}^8C_2$

$= 37$

No. of Re Subsets $= 256 - 37$

$= 219.$

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3. **Answer: d**

Explanation:

$ALLMSA(LLMS) \rightarrow \frac{4!}{2!} = \frac{24}{2} = 12$

$L(ALMS) \rightarrow 4! = 24$

$M(ALLS) \rightarrow \frac{4!}{2!} = \frac{24}{2} = 12$

$SA(MLL) \rightarrow \frac{3!}{2!} = 3$

$SL(ALM) \rightarrow 3! = 6$

Total words $= 12 + 24 + 12 + 3 + 6 = 57$

$SMALL \quad 58^{th}$

$\therefore$ the position of the word $SMALL$ is 58th

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4. Answer: d

Explanation:

The correct answer is D:180

Given that: The periodic number to be formed using digits $1, 1, 2, 2, 2, 2, 2, 3, 4, 4$ to be taken all at a time.

[Note: Means;it is a clear case of combination as only selection is important here]

$\therefore 4_{C_3} \times \frac{3!}{2!} \times \frac{6!}{2! \times 4!} = 180 \quad (\therefore n_{c_k} = \frac{n!}{(n-k)!, k!}) (4_{c_3} = \frac{4!}{1! \times 3!})$

Sol^n: Given that; the possible number to be formed using digits $1, 1, 2, 2, 2, 2, 2, 3, 4, 4$ to be taken all at a time.

[Note: Means; It is a clear case of Combination as " only selection is important here)

$\therefore \quad 4_{C_3} \times \frac{3!}{2!} \times \frac{6!}{2! \times 4!} = 180 \qquad \left(\begin{array}{l} n_{C_k} \\ = \frac{n!}{(n-k)! \cdot k!} \\ 4_{C_3} = \frac{4!}{1! \times 3!} \end{array} \right)$

Ans

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5. Answer: d

Explanation:

Eight digit no divisible by 9 i.e. sum of digits divisible by 9
(i) Total no formed by 1,2,3,4,5, 6,7,8 = 81
(ii) Total no formed by 0,2,3,4,5,6,7,9 = $7 \times 7!$
(iii) Total no formed by 1,0,3,4,5,6,9,8 = $7 \times 7!$
(iv) Total no formed by 1,2,0,4,5,9,7,8 = $7 \times 7!$
(v) Total no formed by 1,2,3,0,5,6,7,8 = $7 \times 7!$
8! + 28 $\times$ 7 !
= 36 $\times$ 7 !

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6. **Answer: a**

Explanation:

$a = {}^{10}C_{10}, b = {}^{20}C_{10}$ and $c = {}^{21}C_{10}$
$\Rightarrow a = {}^{19}C_9, b = 2\left({}^{19}C_9\right)$ and $c = \frac{21}{11}\left({}^{20}C_{10}\right)$
$\Rightarrow b = 2a$ and $c = \frac{21}{11}b = \frac{42a}{11}$
$\Rightarrow a : b : c = a : 2a : \frac{42a}{11} = 11 : 22 : 42$

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7. **Answer: b**

Explanation:

Required number of ways
= Total number of ways - When A and B are always included.
$= {}^5C_2 \cdot {}^7C_3 - {}^5C_1 {}^5C_2 = 300$

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8. **Answer: d**

Explanation:

No. of ways = $10C_3 = 120$

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9. **Answer: 2 – 2**

Explanation:

$$\frac{^{2n}C_3}{^{n}C_3} = 10 \Rightarrow \frac{2n.(2n-1).(2n-2)}{n.(n-1)(n-2)}$$
$$\Rightarrow \frac{(2n-1).2}{n-2}$$
$$\Rightarrow n = 8$$

Therefore, $\frac{n^2+3n}{n^2-3n+4} = \frac{88}{44} = 2$

The answer is 2

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10. **Answer: 432 - 432**

Explanation:

The correct answer is 432
Vowels - I, U, E,
Consonants - N, V, R, S
$\Rightarrow {}^3C_2 \times {}^4C_2 \times 4!$
$= 3 \times 6 \times 24$
$= 432$
So, 432 four letters word can be made

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