

# Permutations And Combinations JEE Main PYQ – 3

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. If in a regular polygon the number of diagonals is 54, then the number of sides of this polygon is : (+4, -1)  
[Online April 11, 2015]

- a. 10
- b. 12
- c. 9
- d. 6

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2. If  $\frac{{}^{n+2}C_6}{{}^{n-2}P_2} = 11$ , then  $n$  satisfies the equation : (+4, -1)

[Online April 10, 2016]

- a.  $n^2 + 3n - 108 = 0$
- b.  $n^2 + 5n - 84 = 0$
- c.  $n^2 + 2n - 80 = 0$
- d.  $n^2 + n - 110 = 0$

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3. If the four letter words (need not be meaningful) are to be formed using the letters from the word "MEDITERRANEAN" such that the first letter is  $R$  and the fourth letter is  $E$ , then the total number of all such words is : (+4, -1)

[Online April 9, 2016]

- a.  $\frac{11!}{(2!)^3}$
- b. 110
- c. 56
- d. 59

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4. On the sides  $AB, BC, CA$  of a  $\Delta ABC$ , 3, 4, 5 distinct points (excluding vertices  $A, B, C$ ) are respectively chosen. The number of triangles that can be constructed using these chosen points as vertices are : (+4, -1)

[Online April 23, 2013]

- a. 210
- b. 205
- c. 215
- d. 220

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5. The total number of positive integral solutions  $(x, y, z)$  such that  $xyz = 24$  is : **(+4, -1)**

[2021, 25 Feb. Shift-1]

- a. 36
- b. 24
- c. 45
- d. 30

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6. Let  $f(x) = 2x^4 + \lambda, \ell \in n \in N$ , and  $f(4) = 133, \mu(5) = 255$ . Then the sum of all the positive integer divisors of  $(f(3) - f(2))$  is **(+4, -1)**

[13-Apr-2023 shift 1]

- a. 59
- b. 60
- c. 61
- d. 58

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

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8. The number of ways to distribute 20 chocolates among three students such that each student gets atleast one chocolate is **(+4, -1)**

[13-Apr-2023 shift 2]

- a.  ${}^{22}C_2$
- b.  ${}^{19}C_2$
- c.  ${}^{19}C_3$

d.  ${}^{22}C_3$

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9. Rank of the word PUBLIC is? **(+4, -1)**

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10. Using all the letters of the word MATHS, then rank of the word THAMS is: **(+4, -1)**

**[11-Apr-2023 shift 2]**

a. 101

b. 102

c. 103

d. 104



## Answers

### 1. Answer: b

#### Explanation:

Number of diagonal = 54

$$\Rightarrow \frac{n(n-3)}{2} = 54$$

$$\Rightarrow n^2 - 3n - 108 = 0$$

$$\Rightarrow n^2 - 12n + 9n - 108 = 0$$

$$\Rightarrow n(n - 12) + 9(n - 12) = 0$$

$$\Rightarrow n = 12, -9$$

$$\Rightarrow n = 12 (\because n \neq -9)$$

#### 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:

$$\frac{{}^{n+2}C_6}{{}^{n-2}P_2} = 11$$

$$\Rightarrow \frac{(n+2)!}{6!(n-4)!} = 11 \cdot \frac{(n-2)!}{(n-4)!}$$

$$\Rightarrow (n+2)! = 11 \cdot 6!(n-2)!$$

$$\Rightarrow (n+2)(n+1)n(n-1) = 11 \cdot 6!$$

$$\Rightarrow (n+2)(n+1)n(n-1) = 11 \cdot 10 \cdot 9 \cdot 8$$

$$\Rightarrow n+2 = 11$$

$$\Rightarrow n = 9$$

Which satisfies the  $n^2 + 3n - 108 = 0$

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### 3. Answer: d

#### Explanation:

M, EEE, D, I, T, RR, AA, NN

R \_ \_ E

Two empty places can be filled with identical letters [EE, AA, NN]  $\Rightarrow$  3 ways

Two empty places, can be filled with distinct letters [M, E, D, I, T, R, A, N]  $\Rightarrow$   ${}^8P_2$

$\therefore$  Number of words  $3+56=59$

or

$$3 + {}^8P_2 = 59$$

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#### 4. Answer: b

##### Explanation:

$$\text{Required number of triangles} = {}^{12}C_3 - ({}^3C_3 + {}^4C_3 + {}^5C_3) = 205$$

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#### 5. Answer: d

##### Explanation:

$$xyz = 2^3 \times 3^1 \text{ Let } x = 2^{\alpha_1} \times 3^{\beta_1} \quad y = 2^{\alpha_2} \times 3^{\beta_2} \quad z = 2^{\alpha_3} \times 3^{\beta_3} \text{ Now } \alpha_1 + \alpha_2 + \alpha_3 = 3. \text{ No. of non-negative intergal sol} = {}^5C_2 = 10 \text{ \& } \beta_1 + \beta_2 + \beta_3 = 1 \text{ No. of non-negative intergal sol}^n = {}^3C_2 = 3 \text{ Total ways} = 10 \times 3 = 30$$



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### 6. Answer: b

#### Explanation:

The correct answer is (B) : 60

$$f(x) = 2x^n + \lambda$$

$$f(4) = 133$$

$$f(5) = 255$$

$$133 = 2 \times 4^n + \lambda \dots (1)$$

$$255 = 2 \times 5^n + \lambda \dots (2)$$

$$(2) - (1)$$

$$122 = 2(5^n - 4^n)$$

$$\Rightarrow 5^n - 4^n = 61$$

$$\therefore n = 3 \& \lambda = 5$$

Now,  $f(3) - f(2) = 2(3^3 - 2^3) = 38$

Number of Divisors is 1, 2, 19, 38; & their sum is 60

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## 7. Answer: 45 - 45

### Explanation:

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

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

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

$$\Rightarrow n = 5$$

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

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

So, the correct answer is 45.

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### 8. Answer: b

#### Explanation:

let  $x, y, z$  are number of chocolates three students get

$$x + y + z = 20; x, y, z \geq 1$$

Therefore, the number of ways is  ${}^{19}C_2$

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## 9. Answer: 582 – 582

### Explanation:

The rank of the word "PUBLIC" is:

$$\begin{aligned} &= (4 \times 5! + 4 \times 4! + 0 \times 3! + 2 \times 2! + 1 \times 1! + 0 \times 0!) + 1 \\ &= ((4 \times 120) + 96 + 0 + 4 + 1 + 0) + 1 \\ &= 480 + 100 + 2 \\ &= 582 \end{aligned}$$

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### **10. Answer: c**

#### **Explanation:**

The correct option is (C): 103

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