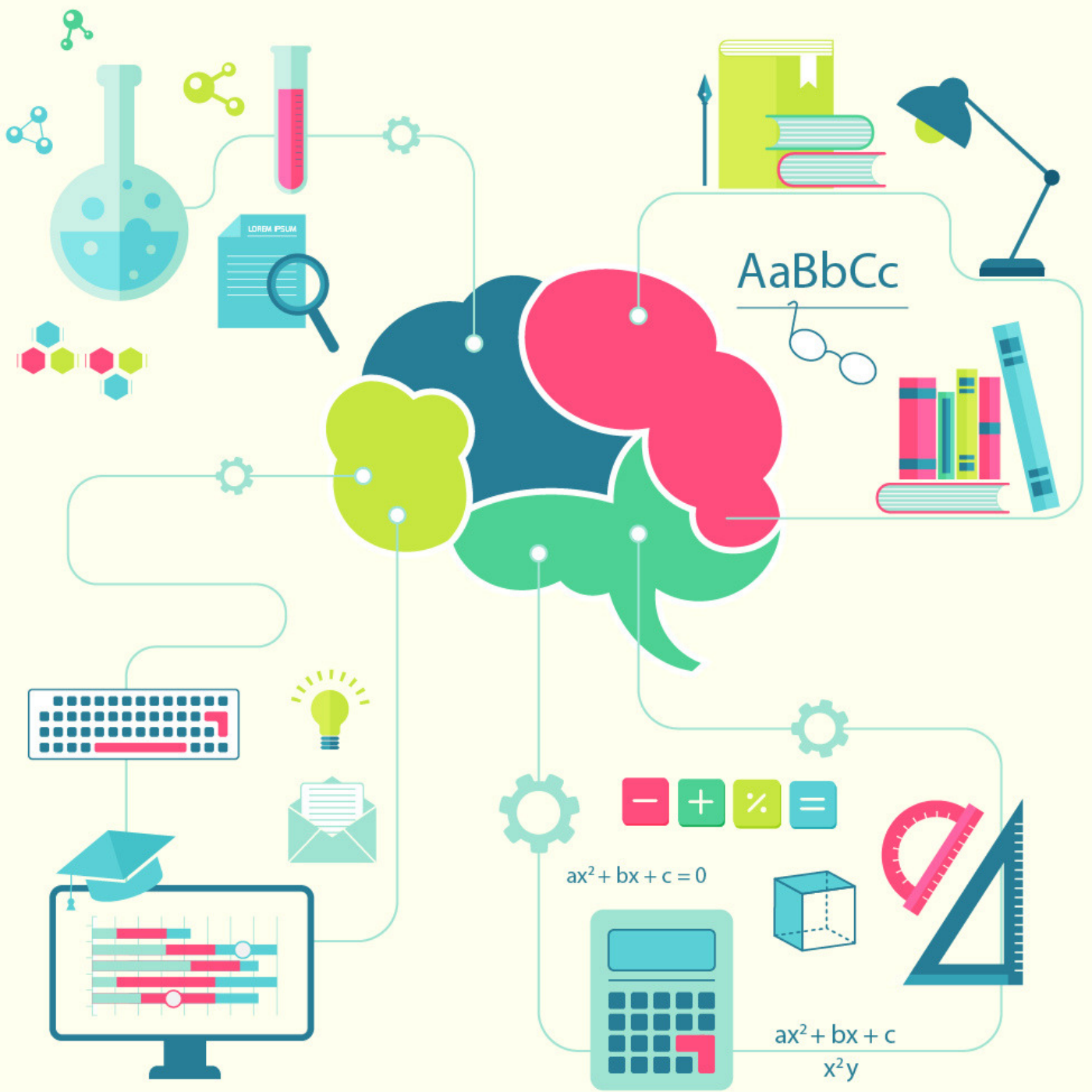


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CAT Questions on Factorial PDF





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Question 1: What is the remainder when $96!$ is divided by 291 ?

- a) 86
- b) 96
- c) 76
- d) 66

Question 2: What is the remainder when $120!120!$ is divided by 120^{24} ?

- a) 2
- b) 1
- c) 0
- d) 3

Question 3: Which digit from the right end of $933!$ is the first non-zero digit?

- a) 300
- b) 232
- c) 400
- d) 320

Question 4: In which position from the right is the first non-zero digit present in $334!$?

- a) 81st
- b) 82nd
- c) 83rd
- d) 84th

Question 5: Find the number of zeroes at the end of $179!$.

- a) 32
- b) 51
- c) 43
- d) 28

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Answers & Solutions:

1) Answer (B)

Using Wilson's theorem, $96! + 1$ is divisible by 97.

Let $96! + 1$ be equal to $97k$ for some natural number k .

Note that $291 = 97 \cdot 3$.

Hence, $96! + 1$ is either $291p$ or $291p + 97$ or $291p + 194$ for some natural number p . This is because $96! + 1$ is a multiple of 97.

We know that $96!$ is divisible by 3. So, $96! + 1$ leaves a remainder of 1 when divided by 3. Using this, we can conclude that $96! + 1$ is of the form $291p + 96$.

Hence, $96!$ leaves a remainder of 96 when divided by 291.

2) Answer (C)

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The product of any five consecutive numbers is divisible by $5!$

So, $1 \cdot 2 \cdot 3 \cdot 4 \cdot 5$ is divisible by 120.

Similarly, $6 \cdot 7 \cdot 8 \cdot 9 \cdot 10$ is also divisible by 120.

$120!$ can be written as $(1 \cdot 2 \cdot 3 \cdot 4 \cdot 5) \cdot (6 \cdot 7 \cdot 8 \cdot 9 \cdot 10) \cdot \dots \cdot (116 \cdot 117 \cdot 118 \cdot 119 \cdot 120)$

Each of the 24 terms is divisible by 120

Hence, the product is divisible by 120^{24}

So, the remainder when $120! \cdot 120!$ is divided by 120^{24}

is 0.

3) Answer (B)

$$\text{Number of zeros in } 933! = \left\lfloor \frac{933}{5} \right\rfloor + \left\lfloor \frac{933}{25} \right\rfloor + \left\lfloor \frac{933}{125} \right\rfloor + \left\lfloor \frac{933}{625} \right\rfloor + \left\lfloor \frac{933}{3125} \right\rfloor + \dots$$

where $\lfloor x \rfloor$ means greatest integer less than or equal to x

$$= 186 + 37 + 7 + 1 + 0$$

$$= 231$$

\Rightarrow 232nd digit from right end is the first non-zero digit.

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4) Answer (B)

$$\begin{aligned}\text{Number of zeros} &= \left\lfloor \frac{334}{5} \right\rfloor + \left\lfloor \frac{334}{25} \right\rfloor + \left\lfloor \frac{334}{125} \right\rfloor + \left\lfloor \frac{334}{625} \right\rfloor \\ &= 66 + 13 + 2 + 0 \\ &= 81 \\ &\Rightarrow 82\text{nd digit is the first non-zero digit}\end{aligned}$$

5) Answer (C)

$$\begin{aligned}\text{Number of zeroes in } 179! &= \left\lfloor \frac{179}{5} \right\rfloor + \left\lfloor \frac{179}{5^2} \right\rfloor + \left\lfloor \frac{179}{5^3} \right\rfloor + \left\lfloor \frac{179}{5^4} \right\rfloor \\ &= 35 + 7 + 1 + 0 \\ &= 43\end{aligned}$$

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