Permutation & Combination

Problem Based on Word's

Que 1. (MTP-18)

In how many ways can the letters of words "ACCOUNTANT" be arranged if vowels always occur together?

(a) 7560 (b7650

(c) 7660 (d) 7550

AOUA, C C N T N T

$\frac{7!}{2! \times 2! \times 2!} \times \frac{4!}{2!} = 7560$

Que 2. (MTP-19)

In how many ways the letters of the word 'ARRANGE' be arranged?

(a) 1,200 (b) 1,250

(c) 1,260 (d) 1,300

$\frac{7!}{2! \times 2!} = 1260$

Que 3. (MTP-19)

In how many ways can the letters of the word 'STRANGE' be arranged so that the vowels never come together?

(a) 3600 (b) 3686

(c) 5040 (d) 4050

Total ways - Ways when they come together. (AE) S, T, R, NG

$7! - [6! \times 2!]$

$5040 - 1440 = 3600$

Que 4. (MTP-21)

Find the number of combinations of the letters of the word COLLEGE taken four together:

(a) 18 (b) 16

(c) 20 (d) 26

LL EE, C, O, G ----

C-1:. Alike, Alike: $^2C_2 = 1$

C-2:. Alike, Diff: $^2C_1 \times {}^4C_2 = 12$

C-3:. All-Diff $= {}^5C_4 = 5$

$\Big\} = 18$ ways.

Que 5. (MTP-22)

Find the number of even numbers greater than 100 that can be formed with the digits 0,1,2,3?

(a) 10 (b) 15

(c) 20 (d) None of these

3 digits → 4 digits

0: $3 \times 2 \times 1 = 6$

2: $2 \times 2 \times 1 = 4$

0: $3 \times 2 \times 1 \times 1 = 6$

2: $2 \times 2 \times 1 \times 1 = 4$

= 20 ways.

Que 6. (MTP-22)

In how many ways can the letters of the word "ALGEBRA" be arranged without changing the relative order of the vowels?

(a) 82 (b) 70

(c) 72 (d) None of these

A _ _ E _ _ A

$\frac{3P_3}{2!} \times {}^4P_4 = \frac{3! \times 4!}{2} = 72$ ways.

Que 7. (MTP-22)

In how many ways can the letters of the word "DIRECTOR" be arranged so that the three vowels are never together?

(a) 180 (b) 18,000

(c) 18,002 (d) None of these

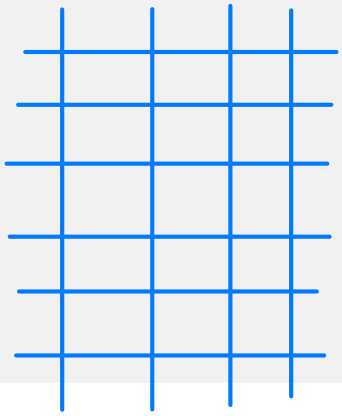
Total ways - when they are together. (EIO) DRCTR

$\frac{8!}{2!} - \left[\frac{6!}{2!} \times 3!\right] = 18000$ ways.

Que 8. **(MTP-22)**	How many words can be formed with the letters of the word 'ORIENTAL.' So that A and E always occupy odd places: (a) 540 (b)8460 (c) 8640 (d) 8450	↓ – ↓ – ↓ – ↓ – $^4P_2 \times {}^6P_6 = 8640$ ways.
Que 9. **(MTP-23)**	The number of words from the letters of the word BHARAT, in which B and H will never come together is (a) 360 (b) 240 (c) 120 (d) None of these	Total ways − when they come together. BH ARAT $\frac{6!}{2!} - [5! \times 2!] = 240$ ways.
Que 10. **(PYQ-22)**	If four letter words are taken with or without meaning from the word 'Logarithm' without repetition, how many words will be formed? (a) 5040 (b) 2520 (c) 3024 (d) 40320	$^9P_4 = 3024$
Problem Based on Numbers		
Que 11. **(MTP-18)**	The sum of all the 4 digits numbers that can be formed with the digits 3, 4, 5, 5 is (a) 18887 (b) 33333 (c) 38887 (d) 56661	(Sum of digits) $(n-1)! \times 1111 =$
Que 12. **(MTP-22)**	How many numbers can be formed with the help of 2,3,4,5,6,1 which is not divisible by 5, given that it is a five-digit number and digits are not repeating? (a) 1200 (b) 400 (c) 600 (d) 1400	↓ ↓ ↓ ↓ *↓ 5 × 4 × 3 × 2 × 5 = 600 ways.
Que 13. **(MTP-23)**	The number of 3-digit odd numbers can be formed using the digits 5,6,7, 8, 9. If repetition is allowed? (a) 56 (b) 75 (c) 95 (d) 45	LDR ↓ ↓ *↓ 5 × 5 × 3 = 75 ways.
Que 14. **(MTP-23)**	How many numbers of 3 digits can be made by using digits 3,5,6,7 *and* 8. No. digit being repeated. (a) 120 (b) 60 (c) 100 (d) None of these	↓ ↓ ↓ 5 × 4 × 3 = 60 ways

Que 15. (PYQ-16)	The number of numbers between 1,000 and 10,000, which can be formed by the digits 1, 2, 3, 4, 5, 6 without repetition is: (a) 720 (b) 180 (c) 360 (d) 540	$\downarrow 6 \quad \downarrow 5 \quad \downarrow 4 \quad \downarrow 3 = 360$ ways.
Que 16. (PYQ-21)	How many numbers of seven-digit numbers which can be formed from the digits 3, 4, 5, 6, 7, 8, 9 no digits being repeated are not divisible by 5? (a) 4320 (b) 4690 (c) 3900 (d) 3890	$\downarrow 6 \times \downarrow 5 \times \downarrow 4 \times \downarrow 3 \times \downarrow 2 \times \downarrow 1 \times \downarrow 6$ (*) $= 4320$ Ans.

Problem Based on Geometry

Que 17. (MTP-18)	A polygon has 44 diagonals then the number of sides are (a) 6 (b) 7 (c) 8 (d) ~~11~~	${}^nC_2 - n = 44$ LHS = RHS No. of diagonals = $\frac{n(n-3)}{2}$ → 11 $44 = 44$ LHS = RHS
Que 18. (MTP-19)	The number of diagonals in a polygon of 6 sides (a) 9 (b) 8 (c) 6 (d) 12	${}^6C_2 - 6 = 9$ ways. $\frac{n(n-3)}{2}$ $\frac{6(3)}{2} = 9$ ways
Que 19. (MTP-20)	The number of triangles that can be formed by choosing the vertices from set of 12 points, seven of which lie on the same straight line is (a) 185 (b) 175 (c) 115 (d) 105	Total ways − ways which don't give us △ ${}^{12}C_3 - {}^7C_3$ $220 - 35 = 185$ ways.
Que 20. (PYQ-17)	The number of parallelograms formed from a set of six parallel lines intersecting another set of four parallel lines is: (a) 360 (b) 90 (c) 180 (d) 45	 2-11-x-axis and 2-11-y-axis ${}^6C_2 \times {}^4C_2$ $= 15 \times 6$ $= 90$ ways.

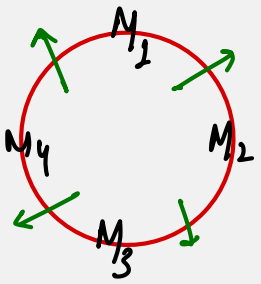
Circular Permutation

Que 21. (MTP-22)

In how many ways can a party of 4 men and 4 women be seated at a circular table, so that no two women are adjacent?

(a) 164 (b) 174

(c) 144 (d) 154



$(4-1)! \times {}^4P_4$

$3! \times 4!$

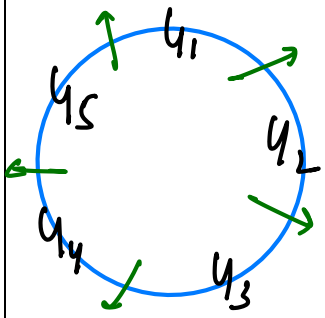
$= 144$ ways

Que 22. (PYQ-22)

The number of ways 5 boys and 5 girls can be seated at a round table, so no two boys are adjacent is:

(a) 2,550 (b) 2,880

(c) 625 (d) 2,476



$(5-1)! \times 5!$

$4! \times 5!$

$= 2880$

Based on Theorems

Que 23. (MTP-19)

A man has 5 friends. In how many ways can be invite one or more of his friends to dinner?

(a) 30 (b) 31

(c) 32 (d) 10

$S_{C_1} + S_{C_2} + S_{C_3} + S_{C_4} + S_{C_5} = 2^n - 1$

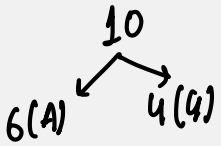
$2^5 - 1 = 31$

Que 24. (MTP-20)

An examination paper with 10 questions consists of 6 questions in Algebra and 4 questions in Geometry. At least one question from each section is to be attempted. In how many ways can this be done?

(a) 945 (b) 100

(c) 1000 (d) none of these



$(2^n - 1)$ and $(2^n - 1)$

$(2^6 - 1) \times (2^4 - 1)$

$63 \times 15 = 945$ Ans.

Que 25. (MTP-20)

In an examination a candidate has to pass in each of the 4 papers. In how many different ways can be failed?

(a) 14 (b) 16

(c) 15 (d) none of these

$4_{C_1} + 4_{C_2} + 4_{C_3} + 4_{C_4} = 2^n - 1$

$2^4 - 1 = 15$ ways.

Que 26. (MTP-20)

In an election the number of candidates is one more than the number of members to be elected. If a voter can vote in 254 different ways; find the number of candidates.

(a) 8 (b) 10

(c) 7 (d) none of these

Que 27. (MTP-21)

A boy has 3 library tickets and 8 books of his interest in the library of these 8, he does not want to borrow mathematics part II unless mathematics part-1 is also borrowed? In how many ways can he choose the three books to be borrowed?

(a) 41 (b) 51

(c) 61 (d) 71

Que 28. (MTP-21)

$5_{C_1} + 5_{C_2} + 5_{C_3} + 5_{C_4} + 5_{C_5}$ is equal to _____

(a) 30 (b) 31

(c) 32 (d) 35

Que 29. (MTP-21)

In how many ways 5 Prizes can be distributed among 3 students equally

(a) 10 (b) 45

(c) 60 (d) 120

Que 30. (MTP-22)

N.A

Three girls and five boys are to be seated in a row so that no two girls sit together. Total no. of arrangements is:

(a) 14,400 (b) 120

(c) 5P3 (d) 3! × 5!

Que 31. (MTP-23)

The number of ways of 4 boys and 3 girls are to be seated for a photograph in a row alternatively.

(a) 24 (b) 164

(c) 144 (d) 336

→ Fixed Distributing

Que 32. (MTP-24) G+D

The number of ways that 12 prizes can be divided among 4 students so that each may have 3 prizes is:

(a) 15,400 (b) 15,000

(c) 14,400 (d) 369600

G x D

$\frac{n!}{p!q!r!(m!)} \times z!$

$\frac{12!}{3!\times3!\times3!\times3!\times4!} \times \cancel{4!} = 369600$

Que 33. (MTP-24) G+D

Not a fixed.

Five balls of different colors are to be placed in three boxes of different sizes. Each box can hold all the five balls. In how many different ways can we place the balls so that no box remains empty?

(a) 100 (b) 120

(c) 150 (d) None of these

1 1 3 $= \frac{5!}{1!\times1!\times3!\times2!} \times 3! = 60$

1 2 2 $= \frac{5!}{1!\times2!\times2!\times2!} \times 3! = 90$

150

Que 34. (PYQ-22)

The number of ways 4 boys and 4 girls can be seated in a row so that they are alternate is:

(a) ~~12~~ 1152 (b) 288

(c) 144 (d) 256

B_1 ✓ B_2 ✓ B_3 ✓ B_4 ✓

$[{}^4P_4 \times {}^4P_4] \times 2 = 1152$ Ans

Miscellaneous

Que 35. (MTP-18)

How many Six-digit telephone numbers can be formed by using 10 distinct digits

(a) 10^8 ✗ (b) 6^{10} ✗

(c) $10C_9$ ✗ (d) $10P_6$

10 10 10 10 10 10 $= (10)^6$ Ans. (R✓)

${}^{10}P_6 = 10\times9\times8\times7\times6\times5$ (R✗)

Que 36. (MTP-18)

In a lawn different ways can four persons stand in a line for a group photograph.

(a) 24 (b) 16

(c) 8 (d) 64

${}^4P_4 = 4! = 24$ Ans.

Que 37. (MTP-18) HDR

A company wishes top simultaneously promotes three of its 8 department assistant managers. In how many ways these promotions can take place?

(a) 336 (b) 56

(c) 8 (d) 1680

${}^8C_3 = 56$

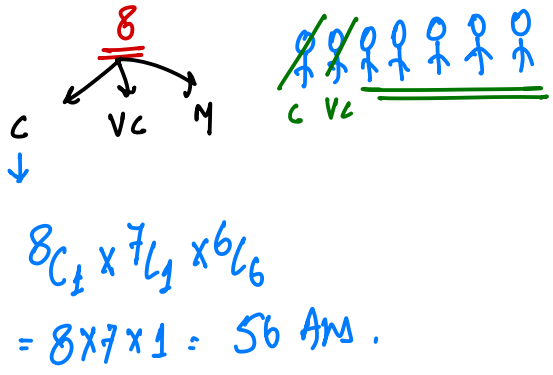
${}^8P_3 = 336$ ✗

Que 38. (MTP-18)

From a committee of 8 persons, in how many ways can we choose a chairman and a vice chairman assuming one person cannot hold more than one position?

(a) 50 (b) 56

(c) 62 (d) none of these

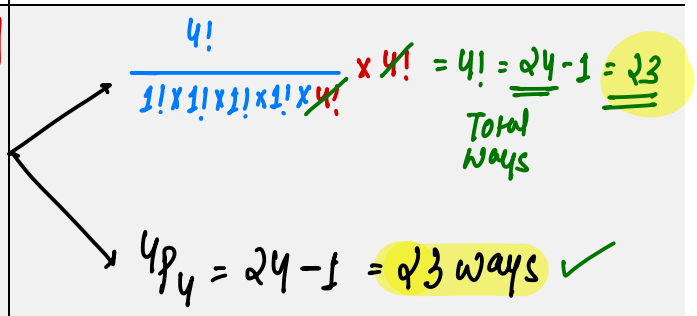


Que 39. (MTP-18)

Four letters are written and 4 envelopes are addressed. The number of ways in which all the letters do not go into correct envelopes is

(a) 511 (b) 1023

(c) 23 (d) 15

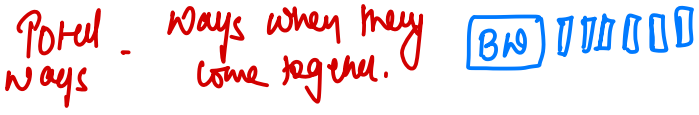


Que 40. (MTP-19)

The number of ways in which 8 examination paper be arranged so that the best and worst papers never come together.

(a) $8! - 2 \times 7!$ (b) $8! - 7!$

(c) $8!$ (d) $7!$

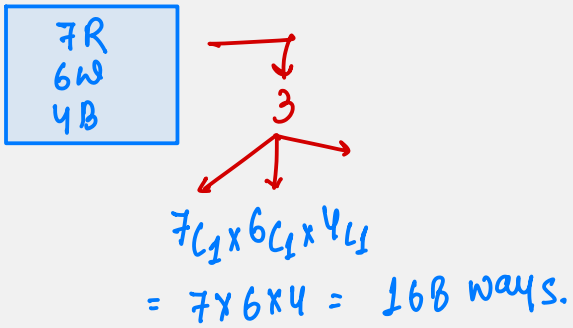


Que 41. (MTP-19)

A box contains 7 red, 6 white and 4 blue balls. How many selections of three balls on of each colour?

(a) 178 (b) 158

(c) 198 (d) 168

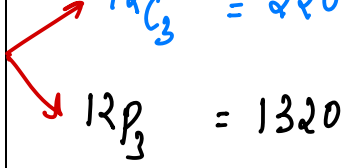


Que 42. (MTP-20)

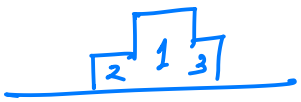
If 12 school teams are participating in a quiz contest, then the number of ways the first, second and third positions may be won is

(a) 1,230 (b) 1,320

(c) 3,210 (d) none of these



A, B, C

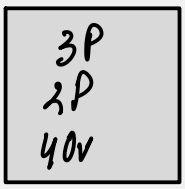


Que 43. (MTP-21)

A box contains 3 pink caps, 2 purple caps and 4 orange caps. In how many ways they can be arranged so that the caps of the same colour come together. (Assume all caps of same colour are not identical)

(a) 1724 (b) 1728

(c) 1732 (d) 1764



$3! \times 3! \times 2! \times 4!$

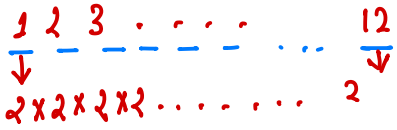
$= 1728$

Que 44. (MTP-21)

There are 12 questions to be answered in Yes or No. how many ways can these be answered?

(a) 1024 (b) 2048

(c) 4096 (d) none



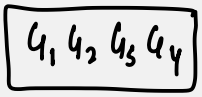
$= (2)^{12} = 4096$

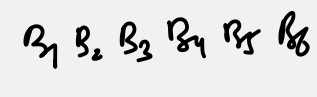
Que 45. (MTP-22)

The number of ways of arranging 6 boys and 4 girls in a row so that all 4 girls are together is:

(a) 6!. 4! (b) 2(7! 4!)

(c) 7! 4! (d) 2(6! 4!)





$7! \times 4!$

Que 46. (MTP-22)

How many different groups of 3 people can be formed from a group of 5 people?

(a) 5 (b) 6

(c) 10 (d) 9

$^5C_3 = 10$

Que 47. (MTP-22)

In how many ways can 4 people be selected at random from 6 boys and 4 girls if there are exactly two girls?

(a) 90 (b) 360

(c) 92 (d) 480

6 Boys, 4 Girls → (4) → 2B, 2G

$^6C_2 \times {}^4C_2 = 15 \times 6$

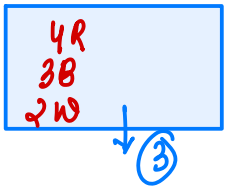
$= 90$ ways.

Que 48. (MTP-23)

A bag contains 4 red, 3 black and 2 white balls. In how many ways 3 balls can be drawn from this bag so that they include at least one black ball?

(a) 64 (b) 46

(c) 85 (d) None of the above



BDD $= {}^3C_1 \times {}^6C_2 =$

BBD $= {}^3C_2 \times {}^6C_1 =$

BBB $= {}^3C_3 =$

Total ways − No Ball in Draw.

$^9C_3 - {}^6C_3$

$= 84 - 20$

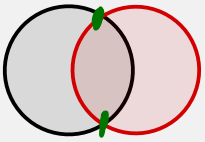
$= 64$ Ans.

Que 49. (MTP-23)

The maximum number of points of intersection of 10 circles will be:

(a) 2 (b) 20

(c) 90 (d) 18



$^{10}C_2 \times 2$

$= 90$ ways.

Que 50. (MTP-23)

There are 5 books on English, 4 Books on Tamil and 3 books on Hindi. In how many ways can these books be placed on a shelf if the books on the same subjects are to be together?

(a) 1,36,800 (b) 1,83,600

(c) 1,03,680 (d) 1,63,800

5E, 4T, 3H

$= 3! \times 5! \times 4! \times 3!$

$= 103680$ Ans.

Que 51. (MTP-24)

A room has 10 doors. In how many ways can a man enter the room by one door and come out by a different door.

(a) 90 (b) 100

(c) 50 (d) None of these

1 0

$^{10}C_1 \times {}^{9}C_1$

$= 10 \times 9 = 90$ ways

Que 52. (MTP-24)

In an election, there are five candidates contesting for three vacancies; an elector can vote any number of candidates not exceeding the number of vacancies. In how many ways can one cast his votes?

(a) 12 (b) 14

(c) 25 (d) None of these

$^{5}C_1 + {}^{5}C_2 + {}^{5}C_3$

$= 5 + 10 + 10$

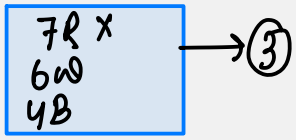
$= 25$ Ans.

Que 53. (MTP-24)

A box contains 7 red, 6 white and 4 blue balls. How many selections of three balls can be made so that none is red?

(a) 90 (b) 120

(c) 48 (d) None of these



$^{10}C_3 = 120$ ways.

Que 54. (MTP-24)

How many ways can 5 different trophies can be arranged on a shelf if one particular trophy must always be in the middle?

(a) 24 (b) 120

(c) 48 (d) 144

T_1 T_2 T_3 T_4 T_5

$+ + T_3 + +$

$4P_4 = 4! = 24$

~~Que 55.~~ (PYQ-15)	There are 6 men and 4 women in a group, then the number of ways in which a committee of 5 persons can be formed of them, if the committee is to include at least 2 women are: (a) 180 (b) 186 (c) 120 (d) 105	6 Men, 4 Women → 5 C-1: WW MMM = $^4C_2 \times {}^6C_3 = 120$ C-2: WWW MM = $^4C_3 \times {}^6C_2 = 60$ C-3: WWWW M = $^4C_4 \times {}^6C_1 = 6$ 186
Que 56. (PYQ-15)	In how many ways can a selection of 6 out of 4 teachers and 8 students be done so as to include at least two teachers? (a) 220 (b) 672 (c) 596 (d) 968	4T, 8S → 6 C-1: TT, SSSS = $^4C_2 \times {}^8C_4 = 420$ C-2: TTT, SSS = $^4C_3 \times {}^8C_3 = 224$ C-3: TTTT, SS = $^4C_4 \times {}^8C_2 = 28$ 672
Que 57. (PYQ-19)	If these are 40 guests in a party. If each guest takes a shake hand with all the remaining guests. Then the total number of hands shake is _____ (a) 780 (b) 840 (c) 1,560 (d) 1,600	$^{40}C_2 = 780$ $^{40}P_2$ = ✗ WRONG.
Que 58. (PYQ-20)	A fruity basket contains 7 apples, 6 bananas, and 4 mangoes. How many selections of 3 fruits can be made so that all 3 are apples? (a) 35 ways (b) 120 ways (c) 165 ways (d) 70 ways	7A, 6B, 4M → $^7C_3 = 35$ ways.
Que 59. (PYQ-20)	Out of 7 boys and 4 girls, a team of a debate club of 5 is to be chosen. The number of teams such that each team includes at least one girl is: (a) 439 (b) 429 (c) 419 (d) 441	7 Boys, 4 Girls → 5 Total ways − No one's girls. $= {}^{11}C_5 - {}^7C_5$ $= 462 - 21 = 441$
Que 60. (PYQ-21)	'n' locks and 'n' corresponding keys are available but the actual combination is not known. The maximum number of trials that are needed to assigns the keys to the corresponding locks is: (a) $^{(n-1)}C_2$ 6 (b) $^{(n+1)}C_2$ = 15 (c) $\sum_{k=2}^{n}(k-1)$ = 1+2+3+4 = 10 (d) $\sum_{k=2}^{n} k$	n = 5 Key = 5 4 + 3 + 2 + 1 + 0 = 10 ways.

Que 61. (PYQ-25)

In how many ways can 5 Doctors 4 Professors, and 6 Auditors be seated in a row so that all person of the same profession sit together?

(a) $3! \times 5!$

(b) $3! \times 5! \times 4!$

(c) $3! \times 5! \times 4! \times 6!$

(d) $3! \times 5! \times 6!$

5D, 4P, 6A

$3! \times 5! \times 4! \times 6!$

Que 62. (PYQ-25)

In how many ways can an interview panel of 3 members be formed from 3 engineers, 2 psychologists and 3 managers if at least 1 engineer must be included?

(a) 30 (b) 15

(c) 46 (d) 45

3E, 2P, 3M

Total ways − No one is Eng.

$^{8}C_3 - {}^{5}C_3 = 46$ Ans.

Algebraic Based Problems

Que 63. (MTP-18)

$^{15}C_{3r} = {}^{15}C_{r+3}$, then r is equal to

(a) 2 (b) 3

(c) 4 (d) 5

$3r + r + 3 = 15$

$4r = 12$

$r = 3$

Que 64. (MTP-18)

$^{n+2}C_n = 45$ find the value of n

(a) 7 (b) 8

(c) 9 (d) 6

LHS = RHS

Que 65. (MTP-19)

If $^{n}P_r = 336$ *and* $^{n}C_r = 56$, then n and r will be

(a) (3, 2) (b) (8, 3)

(c) (7, 4) (d) none of these

$\frac{{}^{n}P_r}{{}^{n}C_r} = r!$ | $\frac{336}{56} = r!$

$r! = 6$

$r = 3$

Que 66. (MTP-23)

The value of N in $\frac{1}{7!} + \frac{1}{8!} = \frac{N}{9!}$ is

(a) 81 (b) 78

(c) 89 (d) 64

$\frac{8+1}{8!} = \frac{N}{9!}$

$\frac{9}{8!} = \frac{N}{9 \times 8!}$

$N = 81$ Ans.

Que 67. (PYQ-18)

If $^{1000}C_{98} = {}^{999}C_{97} + {}^{x}C_{901}$, find x :

(a) 999 (b) 998

(c) 997 (d) 1,000

$^{999}C_{97} + {}^{999}C_{901} =$

$^{999}C_{97} + {}^{999}C_{98} = {}^{1000}C_{98}$

Space for Rough Work