Permutations and Combinations

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. The value of ${}^{6}P_{3}$ is:

(a) 360 **(b)** 20 **(c)** 216 **(d)** 120

2. The value of ${}^{15}C_{5}$ is:

(a) 360,360 **(b)** 5,005 **(c)** 3,003 **(d)** 2,002

3. How many arrangements can be made of all the letters of the word MISSISSIPPI?

(a) 69,300 **(b)** 17,325 **(c)** 39,916,800 **(d)** 34,650

4. How many 2-digit numbers can be formed from the digits 1, 2, 3, 4, 5, 6, 7, if no digit is repeated?

(a) 42 **(b)** 49 **(c)** 21 **(d)** 14

5. 0! equals:

(a) 1 **(b)** undefined **(c)** infinity **(d)** 0

6. In how many ways can a committee of 2 men and 3 women be chosen from 6 men and 5 women?

(a) 1,800 **(b)** 25 **(c)** 462 **(d)** 150

7. (5 + 1)! ÷ (5 − 1)! equals:

(a) 30 **(b)** 20 **(c)** 6 **(d)** 2

8. Assertion (A): ${}^{8}C_{3} = {}^{8}C_{5}$.
Reason (R): Choosing r things to take is the same as choosing the n − r things to leave, so ${}^{n}C_{r} = {}^{n}C_{n-r}$.

(a) Both A and R are true, and R is the correct explanation of A.

(b) Both A and R are true, but R is not the correct explanation of A.

(c) A is true, but R is false.

(d) A is false, but R is true.

Section B — Short answer — 8 × 2 = 16 marks

9. How many arrangements of the letters of CLOUDY are there? How many of them begin with O?

10. How many 3-digit even numbers can be formed from the digits 1 to 7, if no digit is repeated?

11. Find n if ${}^{n}P_{2} = 306$.

12. A committee of 4 is to be chosen from 8 men and 7 women. In how many ways can this be done so that there is at least one woman?

13. In how many arrangements of the letters of ORANGE do N and G come together?

14. If ${}^{n}C_{6} = {}^{n}C_{10}$, find n and ${}^{n}C_{2}$.

15. At a meeting, each of 17 people shakes hands with every other person once. How many handshakes are there?

16. There are 10 points in a plane, of which exactly 6 are collinear (no other three are). How many straight lines and how many triangles can be formed by joining them?

Section C — Word problems — 4 × 4 = 16 marks

17. (a) How many arrangements of the letters of TOMATO are there? (b) In how many of them do all the vowels come together?

18. A team of 4 is chosen from 9 boys and 8 girls. In how many ways can it be chosen if it must have at least 2 girls?

19. In how many ways can 3 cards be chosen from a pack of 52 cards? In how many of these is there (a) exactly one ace, (b) at least one ace?

20. 7 boys and 6 girls stand in a row. In how many ways can they stand (a) in any order, (b) so that boys and girls alternate, (c) so that all the girls stand together?

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Answer key

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Q	Answer	Working
1	**(d) 120**	$6 \times 5 \times 4$
2	**(c) 3,003**	$15! \div (5! \times 10!)$
3	**(d) 34,650**	$11!$ ÷ (repeats: I × 4, S × 4, P × 2)
4	**(a) 42**	${}^{7}P_{2}$
5	**(a) 1**	—
6	**(d) 150**	${}^{6}C_{2} \times {}^{5}C_{3}$
7	**(a) 30**	6×5
8	**(a) Both A and R are true, and R is the correct explanation of A.**	A is true: ${}^{8}C_{3} = 56$ and ${}^{8}C_{5} = 56$. R is true and explains A.
9	**720; 120**	6!; fix O, then 5!
10	**90**	units digit: 3 even choices; the rest: ${}^{6}P_{2}$
11	**n = 18**	$n(n - 1) = 306$
12	**1,295**	all committees ${}^{15}C_{4}$ minus all-men ${}^{8}C_{4}$
13	**240**	treat NG as one block: 5! × 2!
14	**n = 16; ${}^{16}C_{2} = 120$**	${}^{n}C_{r} = {}^{n}C_{s}$ with $r \neq s$ means $r + s = n$
15	**136**	${}^{17}C_{2}$
16	**Lines: 31; triangles: 100**	${}^{10}C_{2} - {}^{6}C_{2} + 1$; ${}^{10}C_{3} - {}^{6}C_{3}$
17	**(a) 180; (b) 36**	(b) treat the vowels OAO as one block: 12 arrangements of the block and the consonants, × 3 arrangements of the vowels inside it
18	**1,582**	2 girls: ${}^{8}C_{2} \times {}^{9}C_{2} = 1{,}008$; 3 girls: ${}^{8}C_{3} \times {}^{9}C_{1} = 504$; 4 girls: ${}^{8}C_{4} \times {}^{9}C_{0} = 70$
19	**22,100; (a) 4,512; (b) 4,804**	${}^{52}C_{3}$; ${}^{4}C_{1} \times {}^{48}C_{2}$; ${}^{52}C_{3} - {}^{48}C_{3}$ (hands with no ace)
20	**(a) 6,227,020,800; (b) 3,628,800; (c) 29,030,400**	(b) 7! × 6!; (c) girls as one block: 8! × 6!

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