RVHS H2 Mathematics Remedial Programme

Topic: Permutation & Combination

Basic Mastery Questions

1. There are 5 boys and 7 girls. A team of 4 is to be formed by selecting from these 12 people.

(a) Find the number of ways in which the team consists of either 4 boys or 4 girls.

(b) Find the number of ways in which the team consists of exactly 2 boys and 2 girls.

RVHS JC Skills Builder:

Learn to reason that one of the parts of the question needs you to apply the Addition Principle, while the other requires the Multiplicative Principle.

Click here or scan this  to view video example on when to use Addition Principle!

Click here or scan this  to view video example on when to use Multiplicative Principle!

Answer: (a) 40 (b) 210

(a) No. of ways $= {}^{5}C_{4} + {}^{7}C_{4} = 40$

(b) No. of ways $= {}^{5}C_{2} \times {}^{7}C_{2} = 210$

2. **ACJC Prelim 9758/2021/Q7(i)**

A group of 12 students consists of 3 students from class *A*, 4 students from class *B* and 5 students from class *C*.

Find the number of ways in which a committee of 8 students can be chosen from the 12 students if it includes **at least** 1 student from each class. [2]

RVHS JC Skills Builder:

First of all, learn to observe that questions with phrases such as "at least". "not more than", "at most", etc, *could* be solved by Listing Out Cases OR using the Complementary approach.

Then, click here or scan this  to view video example on solving by Listing Out Cases!

Then, click here or scan this  to view video example on solving by Complementary approach!

Answer: 485

$$\begin{aligned}\text{No. of ways} &= {}^{12}\text{C}_8 - {}^{9}\text{C}_8 - {}^{8}\text{C}_8 \\ &= 495 - 9 - 1 \\ &= 485\end{aligned}$$

3. **YIJC Prelim 9758/2021/Q5(ii)**

9 students consisting of 4 from Class *A* and 5 from Class *B* are seated at a round table with 10 chairs.

How many different seating arrangements can be formed if **no two** students from Class *A* are **seated next to each other**? [2]

RVHS JC Skills Builder:

Such question that requires objects to be separated are best solve by "Slot-in" method. We do not usually use the Complementary approach.

Click here or scan this to view video example on solving by "Slot-in" method!

Click here or scan this to view video example on solving questions involving permutation of distinct objects in a circular arrangement!

Answer: 43200

$$\begin{aligned}\text{No of ways} &= (6-1)! \times {}^{6}C_4 \times 4! \\ &= 43200\end{aligned}$$

4. **RI Prelim 9758/2021/Q8(i)**

This question is about arrangements of all eight letters in the word IMMUNITY.

Show that the number of different arrangements of the eight letters that can be made is 10080.[1]

RVHS JC Skills Builder:

Click here or scan this to view video example on how to permutate group of objects that consists of identical objects!

The number of different arrangements $= \frac{8!}{2!2!} = 10080$ (shown)

5. **EJC Prelim 9758/2021/Q8(i)**

Mei Li has 3 types of gemstones comprising 6 Emeralds, 4 Sapphires and 3 Labradorites. All the gemstones are of different sizes.

Find the number of ways Mei Li can arrange all the gemstones in a circle, where the biggest of each type of gemstone are together. [2]

RVHS JC Skills Builder:

Click here or scan this to view video example on how to tackle objects that need to be grouped!

Answer: 21772800

# of ways to arrange the 3 gemstones = 3!

# of ways to arrange 11 units = (11-1)!

Total # of ways $= 3! \times (11-1)! = 21772800$

Standard Questions

1. **ACJC Prelim 9758/2021/Q7(ii), modified**

A group of 12 students consists of 3 students from class *A*, 4 students from class *B* and 5 students from class *C*.

The 12 students from the 3 classes sit at random at a round table. Albert is a student from class *A* and Bob is a student from class *B*. Find the number of ways that Albert and Bob are seated together and no two students from class *A* are next to each other. [2]

Answer: 4515840

Number of ways required $= (9-1)! \times 2 \times {}^{8}\mathrm{C}_{2} \times 2! = 4515840$

2. **ASJC Prelim 9758/2021/Q7(i),(ii)**

Four friends went for a Christmas party, each bringing a present for gift exchange. During the gift exchange, the presents were randomly distributed, such that each person received exactly one gift, which may be the same or different from the present that he brought along. It is given that the presents brought to the Christmas party were all distinct from one another.

(i) Find the total number of ways to distribute the four presents to the four people if there are no restrictions. [1]
(ii) Find the number of ways the presents can be distributed if there is exactly one person who received back their own presents. [2]

Answer: (i) 24 (ii) 8

(i) No of ways required = 4! = 24

(ii) No of ways required = ${}^{4}C_{1} \times {}^{2}C_{1} \times {}^{1}C_{1} = 8$

Alternative solution

Correct present	Listing	No of ways
A	A,C,D,B or A,D,B,C	2
B	C,B,D,A or D,B,A,C	2
C	B,D,C,A or D,A,C,B	2
D	B,C,A,D or C,A,B,D	2

3. **TJC Prelim 9758/2020/Q7(i),(ii),(iii)**

The diagram shows a 3×3 grid of 9 cells, numbered 1 to 9.

1	2	3
4	5	6
7	8	9

The nine letters T, T, T, T, J, C, C, C, C are to be arranged in the grid, with each cell occupied by one letter. Find the number of ways to arrange the nine letters if
(i) there are no other restrictions, [2]
(ii) the cells at the four corners of the grid must each be occupied by a 'T'. [1]

Two letters are considered adjacent to each other if they occupy cells that are above, below, to the left or to the right of each other. Find the number of ways to arrange the nine letters if
(iii) all 'T's must not be adjacent to another 'T' and all 'C's must not be adjacent to another 'C', [2]

Answer: (i) 630 (ii) 5 (iii) 10

(i) No. of ways = $\frac{9!}{4!4!} = 630$

(ii) No. of ways = ${}^5C_1 = 5$ or $\frac{5!}{4!} = 5$

(iii) No. of ways = ${}^2C_1 \times {}^5C_1 = 10$

(${}^2C_1$: Cells 2, 4, 6 and 8 all occupied by either 'T' or 'C'; ${}^5C_1$: choose cell for 'J')