Unit 1 · Permutation and Combination

WORKSHEET

Full marks 37

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 37

1 Key words [4]

Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

binomial	**circular**	**combination**	**counting**	**factorial**	**necklace**	**Pascal's**	**permutation**
probability	**sequence**						

An arrangement of objects in which order matters is a _____; a selection in which order doesn't matter is a _____. The product $n(n-1)(n-2)\cdots 1$ is called n _____. If one job can be done in m ways and then another in n ways, the two together can be done in mn ways: this is the basic principle of _____. People seated round a table make a _____ arrangement. A _____ can be turned over, so it has half as many arrangements as people at a table. The rule $C(n, r) + C(n, r-1) = C(n+1, r)$ is _____ rule, and the numbers it builds are the _____ coefficients.

2 True or false [3]

Write ✓ for a true statement and ✗ for a false one. Correct the false ones.

i. $0! = 1$. ☐

ii. Six people can sit round a table in 6! ways. ☐

iii. $C(12, 5) = C(12, 7)$. ☐

iv. The number of three-digit PINs, a digit allowed again, is $P(10, 3)$. ☐

v. Choosing a captain and a vice-captain from 11 players is counted by $C(11, 2)$. ☐

vi. $P(n, r) = r! \times C(n, r)$. ☐

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. $C(n, r) + C(n, r-1)$ is equal to: [1]

a. $C(n+1, r)$ **b.** $C(n+1, r-1)$

c. $C(n, r+1)$ **d.** $C(2n, 2r-1)$

ii. The number of arrangements of the letters of KATHMANDU is: [1]

a. 9! **b.** $\frac{9!}{2!}$

c. $\frac{9!}{2!\,2!}$ **d.** 8!

iii. In how many ways can 5 boys and 3 girls stand in a row if the 3 girls stand together? [1]

a. 720 **b.** 2160

c. 4320 **d.** 40,320

iv. Ten points lie in a plane, no three on a line except 4 of them, which are on one line. How many different straight lines can be drawn, each through two of the points? [1]

a. 45 **b.** 40

c. 39 **d.** 6

v. Ten chairs stand in a row. In how many ways can 3 of them be chosen so that no two chosen chairs are side by side? [1]

a. 120 **b.** 64

c. 56 **d.** 36

4 Short answers [9]

Write short answers to the following questions.

a. Explain why n different people can sit round a table in $(n-1)!$ ways and not $n!$ ways. [2]

b. If $P(n, 4) = 20\,P(n, 2)$, find n. [2]

c. Prakash counted the arrangements of the letters of DHANGADHI in which no two vowels are side by side like this: "All arrangements $\frac{9!}{2!\,2!\,2!} = 45{,}360$; with the vowels A, A, I together $\frac{7!}{2!\,2!} \times 3 = 3780$; so the answer is $45{,}360 - 3780 = 41{,}580$." What has he counted? Find the right answer. [2]

d. $C(n, r-1) = 36$, $C(n, r) = 84$ and $C(n, r+1) = 126$. Find n and r. [3]

5 Long answers [13]

Write long answers to the following questions. Show your working.

a. A committee of 6 is to be chosen from 7 men and 5 women. **[5]**

i. In how many ways can it have exactly 2 women?

ii. In how many ways can it have at least 2 women?

iii. Ram and Sita are among them and refuse to serve together. In how many ways can the committee be chosen?

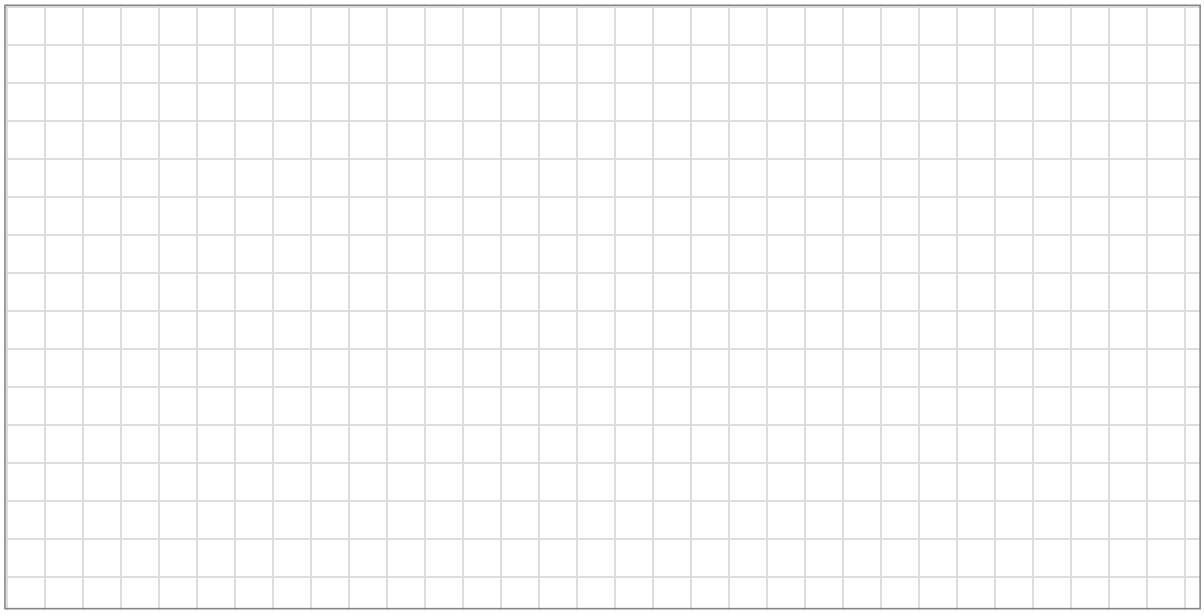
b. Five-digit numbers are made from the digits 0, 1, 2, 3, 4, 5, no digit used twice. **[8]**

i. How many such numbers are there?

ii. How many of them are even?

iii. How many are divisible by 5?

iv. How many are greater than 40,000?



Answer: _____

6 Think [3]

A class has n boys and n girls. By counting the ways to choose 2 students from the class in two ways, show that $C(2n, 2) = 2\,C(n, 2) + n^2$. Check it for $n = 7$.

7 Activity: Shortest routes on a grid of streets (not marked)

Draw a grid of streets 3 blocks wide and 2 blocks high. A walker goes from the bottom left corner to the top right corner, always east (E) or north (N). Write every shortest route as a word of E's and N's, such as EENEN, and count them.

Routes that start with E	Routes that start with N	All routes

How many letters does each word have, and how many of them are N? Which formula of this unit gives your count?