NCERT Solutions for Class-XI Maths

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Chapter-7 Exercise-Miscellaneous

NCERT Math Class 11

1. How many words, with or without meaning, each of 2 vowels and 3 consonants can be formed from the letters of the word DAUGHTER?

1. In the word DAUGHTER, there are 3 vowels namely, A, U, and E, and 5 consonants namely, D, G, H, T, and R.

Number of ways of selecting 2 vowels out of 3 vowels $= {}^3C_2 = 3$

Number of ways of selecting 3 consonants out of 5 consonants $= {}^5C_3 = 10$

Therefore, number of combinations of 2 vowels and 3 consonants $= 3 \times 10 = 30$

Each of these 30 combinations of 2 vowels and 3 consonants can be arranged among themselves in 5 ! ways.

Hence, required number of different words $= 30 \times 5! = 3600$

2. How many words, with or without meaning, can be formed using all the letters of the word EQUATION at a time so that the vowels and consonants occur together?

2. In the word EQUATION there are 5 vowels (A, E, I, O, U) and 3 consonants (Q, T,N)

The numbers of ways in which 5 vowels can be arranged are ${}^5c_5$

$$\Rightarrow \frac{5!}{(5-5)!} = \frac{5\times4\times3\times2\times1}{0!} = \frac{120}{1} = 120 \ \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Similarly, the numbers of ways in which 3 consonants can be arranged are ${}^3C_3$

$$\Rightarrow \frac{3!}{(3-3)!} = \frac{3\times2\times1}{0!} = \frac{6}{1} = 6 \ldots\ldots\ldots\ldots\ldots (2)$$

There are two ways in which vowels and consonants can appear together

(AEIOU)(QTN) or (QTN)(AEIOU)

∴ the total number of ways in which vowel and consonant can appear together are:

$2 \times {}^5C_5 \times {}^3C_3$

∴ $2 \times 120 \times 6 = 1440$

3. A committee of 7 has to be formed from 9 boys and 4 girls. In how many ways can this be done when the committee consists of:

(i) exactly 3 girls?

(ii) atleast 3 girls?

(iii) atmost 3 girls?

3. (i) A committee of 7 has to be formed from 9 boys and 4 girls.

Since exactly 3 girls are to be there in every committee, each committee must consist of $(7-3)=4$ boys only.

Thus, in this case, required number of ways $={}^4C_3 \times {}^9C_4 = \frac{4!}{3!1!} \times \frac{9!}{4!5!}$

$= 4 \times \frac{9\times 8\times 7\times 6\times 5!}{4\times 3\times 2\times 1\times 5!}$

$= 504$

(ii) Since at least 3 girls are to be there in every committee, the committee can consist of

(a) 3 girls and 4 boys or

(b) 4 girls and 3 boys

3 girls and 4 boys can be selected in ${}^4C_3 \times {}^9C_4$ ways.

4 girls and 3 boys can be selected in ${}^4C_4 \times {}^9C_3$ ways.

Therefore, in this case, required number of ways $={}^4C_3 \times {}^9C_4 + {}^4C_4 \times {}^9C_3$

$= 504 + 84 = 588$

(iii) Since atmost 3 girls are to be there in every committee, the committee can consist of

(a) 3 girls and 4 boys

(b) 2 girls and 5 boys

(c) 1 girl and 6 boys

(d) No girl and 7 boys

3 girls and 4 boys can be selected in ${}^4C_3 \times {}^9C_4$ ways.

2 girls and 5 boys can be selected in ${}^4C_2 \times {}^9C_5$ ways.

1 girl and 6 boys can be selected in ${}^4C_1 \times {}^9C_6$ ways.

No girl and 7 boys can be selected in ${}^4C_0 \times {}^9C_7$ ways.

Therefore, in this case, required number of ways

$={}^4C_3 \times {}^9C_4 + {}^4C_2 \times {}^9C_5 + {}^4C_1 \times {}^9C_6 + {}^4C_0 \times {}^9C_7$

$= \frac{4!}{3!1!} \times \frac{9!}{4!5!} + \frac{4!}{2!2!} \times \frac{9!}{5!4!} + \frac{4!}{1!3!} \times \frac{9!}{6!3!} + \frac{4!}{0!4!} \times \frac{9!}{7!2!}$

$= 504 + 756 + 336 + 36$

$= 1632$

4. If the different permutations of all the letter of the word EXAMINATION are listed as in a dictionary, how many words are there in this list before the first word starting with E?

4. In dictionary words are listed alphabetically, so to find the words Listed before E should start with letter either A, B, C or D

But the word EXAMINATION doesn`t have B, C or D

Hence the words should start with letter A

The remaining 10 places are to be filled by the remaining letters of the word EXAMINATION which are E, X, A, M, 2N, T, 2I, 0

Since the letters are repeating the formula used would be

$$= \frac{n!}{p_1!p_2!p_{3!}}$$

Where n is remaining number of letters

p_1 and p_2 are number of times the repeated terms occurs.

$$= \frac{10!}{2!2!} = 907200$$

The number of words in the list before the word starting with E

= words starting with letter A = 907200

5. How many 6-digit numbers can be formed from the digits 0,1,3,5,7 and 9 which are divisible by 10 and no digit is repeated?

5. A number is divisible by 10 if its units digits is 0.

Therefore, 0 is fixed at the units place.

Therefore, there will be as many ways as there are ways of filling 5 vacant places

□□□□□0 in succession by the remaining 5 digits (i.e., 1, 3, 5, 7 and 9).

The 5 vacant places can be filled in 5 ! ways.

Hence, required number of 6-digit numbers $= 5! = 120$

6. The English alphabet has 5 vowels and 21 consonants. How many words with two different vowels and 2 different consonants can be formed from the alphabet?

6. There are 5 vowels and 21 consonants in English alphabets.

Choosing two vowels out of 5 would be done in ${}^5C_2$ ways

Choosing 2 consonants out of 21 can be done in ${}^{21}C_2$ ways

The total number of ways selecting 2 vowels and 2 consonants

$= {}^5C_2 \times {}^{21}C_2$

$$\Rightarrow \frac{5!}{2!3!} \times \frac{21!}{2!19!} = \frac{5\times4\times3!}{2!3!} \times \frac{21\times20\times19!}{2\times1\times19!} = 2100$$

Each of these four letters can be arranged in four ways ${}^4P_4$

$$\Rightarrow \frac{4!}{0!} = 4\times3\times2\times1 = 24 \text{ ways}$$

Total numbers of words that can be formed are
$24 \times 2100 = 50400$

7. In an examination, a question paper consists of 12 questions divided into two parts i.e., Part I and Part II, containing 5 and 7 questions, respectively. A student is required to attempt 8 questions in all, selecting at least 3 from each part. In how many ways can a student select the questions?

7. It is given that the question paper consists of 12 questions divided into two parts - Part I and Part II, containing 5 and 7 questions, respectively.
A student has to attempt 8 questions, selecting at least 3 from each part.
This can be done as follows.
(a) 3 questions from part I and 5 questions from part II
(b) 4 questions from part I and 4 questions from part II
(c) 5 questions from part I and 3 questions from part II
3 questions from part I and 5 questions from part II can be selected in ${}^5C_3 \times {}^7C_5$ ways.
4 questions from part I and 4 questions from part II can be selected in ${}^5C_4 \times {}^7C_4$ ways.
5 questions from part I and 3 questions from part II can be selected in ${}^5C_5 \times {}^7C_3$ ways.
Thus, required number of ways of selecting questions
$= {}^5C_3 \times {}^7C_5 + {}^5C_4 \times {}^7C_4 + {}^5C_5 \times {}^7C_3$
$= \frac{5!}{2!3!} \times \frac{7!}{2!5!} + \frac{5!}{4!1!} \times \frac{7!}{4!3!} + \frac{5!}{5!0!} \times \frac{7!}{3!4!}$
$= 210 + 175 + 35 = 420$

8. Determine the number of 5-card combinations out of a deck of 52 cards if each selection of 5 cards has exactly one king.

8. A deck of cards has 4 kings.
The numbers of remaining cards are 52.
Ways of selecting a king from the deck = ${}^4C_1$
Ways of selecting the remaining 4 cards from 48 cards= ${}^{48}C_4$
Total number of selecting the 5 cards having one king always
= ${}^4C_1 \times {}^{48}C_4$
$= \frac{4!}{1!3!} \times \frac{48!}{4!44!} = \frac{4 \times 3!}{3!} \times \frac{48 \times 47 \times 46 \times 45 \times 44!}{4 \times 3 \times 2 \times 1 \times 44!} = 778320$

9. It is required to seat 5 men and 4 women in a row so that the women occupy the even places. How many such arrangements are possible?

9. 4 men and 4 women are to be seated in a row such that the women occupy the even places.

The 5 men can be seated in 5! ways. For each arrangement, the 4 women can be seated only at the cross marked places (so that women occupy the even places).

$M \times M \times M \times M \times M$

Therefore, the women can be seated in 4 ! ways.

Thus, possible number of arrangements $= 4! \times 5! = 24 \times 120 = 2880$

10. From a class of 25 students, 10 are to be chosen for an excursion party. There are 3 students who decide that either all of them will join or none of them will join. In how many ways can the excursion party be chosen?

10. There are 2 options

Either all 3 will go	None of them will go
The remaining students in class are 25-3= 22	The students going will be 10
Number of students remained to be chosen for party = 7	Remaining students eligible for going = 22
Number of ways of choosing the remaining 22 students $= {}^{22}C_7$	Number of ways in which these 10 students c selected are
$= \frac{22!}{7!15!} = 170544$	${}^{22}C_{10}$
	$= \frac{22!}{10!12!} = 646646$

Total numbers of ways in which students can be chosen are

=170544 + 646646

= 817190

11. In how many ways can the letters of the word ASSASSINATION be arranged so that all the S's are together?

11. In the given word ASSASSINATION, the letter A appears 3 times, S appears 4 times, I appears 2 times, N appears 2 times, and all the other letters appear only once. Since all the words have to be arranged in such a way that all the Ss are together, SSSS is treated as a single object for the time being. This single object together with the remaining 9 objects will account for 10 objects.

These 10 objects in which there are 3 As, 2 Is, and 2 Ns can be arranged in $\frac{10!}{3!2!2!}$ ways.

Thus,

Required number of ways of arranging the letters of the given word $= \frac{10!}{3!2!2!} = 151200$