RD Sharma Solutions Class 11 Maths Chapter 16 Ex 16.4

Permutations Ex 16.4 Q1

There are 4 vowels and 3 consonants in the word 'FAILURE'

We have to arrange 7 letters in a row such that consonants occupy odd places. There are 4 odd places $(1,3,5,7)$. There consonants can be arranged in these 4 odd places in ${}^4P_3$ ways.

Remaining 3 even places $(2,4,6)$ are to be occupied by the 4 vowels. This can be done in ${}^4P_3$ ways.

Hence, the total number of words in which consonants occupy odd places = ${}^4P_3 \times {}^4P_3$

$$= \frac{4!}{(4-3)!} \times \frac{4!}{(4-3)!}$$

$$= 4 \times \times 3 \times 2 \times 1 \times 4 \times 3 \times 2 \times 1$$

$$= 24 \times 24$$

$$= 576.$$

Permutations Ex 16.4 Q2

There are 7 letters in the word ' STRANGE', including 2 vowels (A, E) and 5 consonants (S, T, R, N, G).

(i) Considering 2 vowels as one letter, we have 6 letters which can be arranged in ${}^6p_6 = 6!$ ways

A, E can be put together in $2!$ ways.

Hence, required number of words

$= 6! \times 2!$

$= 6 \times 5 \times 4 \times 3 \times 2 \times 1 \times 2$

$= 720 \times 2$

$= 1440.$

(ii) The total number of words formed by using all the letters of the words 'STRANGE'

is ${}^7p_7 = 7!$

$= 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

$= 5040.$

So, the total number of words in which vowels are never together

= Total number of words − number of words in which vowels are always together

$= 5040 - 1440$

$= 3600$

(iii) There are 7 letters in the word 'STRANGE'. out of these letters 'A' and 'E' are the vowels.

There are 4 odd places in the word 'STRANGE'. The two vowels can be arranged in ${}^4p_2$ ways.

The remaining 5 consonants can be arranged among themselves in ${}^5p_5$ ways.

The total number of arrangements

$= {}^4p_2 \times {}^5p_5$

$= \frac{4!}{2!} \times 5!$

$= 1440$

Permutations Ex 16.4 Q3

There are 6 letters in the word 'SUNDAY'. The total number of words formed with these 6 letters is the number of arrangements of 6 items, taken all at a time, which is equal to $^6P_6 = 6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$.

If we fix up D in the beginning, then the remaining 5 letters can be arranged in $^5P_5 = 5!$ ways.

so, the total number of words which begin with D = 5!

$= 5 \times 4 \times 3 \times 2 \times 1 = 120.$

Permutations Ex 16.4 Q4

There are 4 vowels and 4 consonants in the word 'ORIENTAL'. We have to arrange 8 leeters in a row such that vowels occupy odd places. There are 4 odd places $(1,3,5,7)$. Four vowels can be arranged in these 4 odd places in 4! ways. Remaining 4 even places $(2,4,6,8)$ are to be occupied by the 4 consonants.

This can be done in 4! ways.

Hence, the total number of words in which vowels occupy odd places = $4! \times 4!$

$= 4 \times 3 \times 2 \times 1 \times 4 \times 3 \times 2 \times 1$

$= 576.$

Permutations Ex 16.4 Q5

There are 6 letters in the word 'SUNDAY'. The total number of words formed with these 6 letters is the number of arrangements of 6 items, taken all at a time, which is equal to $^6P_6 = 6!$

$= 6 \times 5 \times 4 \times 3 \times 2 \times 1$

$= 720.$

If we fix up N in the begining, then the remaining 5 letters can be arranged in $^5P_5 = 5!$ ways

so, the total number of words which begin which $N = 5!$

$= 5 \times 4 \times 3 \times 2 \times 1$

$= 120$

if we fix up N in the begining and Y at the end, then the remaining 4 letters can be arranged in $^4P_4 = 4!$ ways.

So, the total number of words which begin with N and end with $Y = 4! = 4 \times 3 \times 2 \times 1 = 24.$

Permutations Ex 16.4 Q6

There are 10 letters in the word 'GANESHPURI'. The total number of words formed is equal to $^{10}P_{10} = 10!$

(i) If we fix up G in the begining, then the remaining 9 letters can be arranged in $^{9}P_{9} = 9!$ ways

(ii) If we fix up P in the begining and I at the end, begining 8 letters can be arranged in $^{8}P_{8} = 8!$.

(iii) There are 4 vowels and 6 consonants in the word 'GANESHPURI'.

Considening 4 vowels as one letter,

We have 7 letters which can be arranged in $^{7}P_{7} = 7!$ ways.

A,E,U,I can be put together in 4! ways.

Hence, required number of words = $7! \times 4!$.

(iv) We have to arrange 10 letters in a row such that vowels occupy even places. There are 5 even places $(2,4,6,8,10)$. 4 vowels can be arranged in these 5 even places in $^{5}P_{4}$ ways.

Remaining 5 odd places $(1,3,5,7,9)$ are to be occupied by the 6 consonants.

This can be done in $^{6}C_{5}$ ways.

Hence, the total number of words in which vowels occupy even places = $^{5}P_{4} \times {}^{6}P_{5}$

$$= \frac{5!}{(5-4)!} \times \frac{6!}{(6-1)!}$$

$$= 5! \times 6!$$

Permutations Ex 16.4 Q7

(i) There are 6 letters in the word 'VOWELS'. The total number of words formed with these 6 letters is the number of arrangements of 6 items, taken all at a time, which is equal to

$${}^6P_6 = 6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$$

(ii) If we fix up E in the begining then the remaining 5 letters can be arranged in ${}^5P_5 = 5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$ ways

(iii) If we fix up O in the begining and L at the end, the remaining 4 letters can be arranged in ${}^4P_4$

$$= 4! = 4 \times 3 \times 2 \times 1 = 24.$$

(iv) There are 2 vowels and 4 consonants in the word 'VOWELS'.

Considering 2 vowels as one letter, we have letters which can be arranged in

$${}^5P_5 = 5! \text{ ways.}$$

O, E can be put together in 2! ways.

Hence, required number of

$$\begin{aligned} \text{words} &= 5! \times 2! \\ &= 5 \times 4 \times 3 \times 2 \times 1 \times 2 \times 1 \\ &= 120 \times 2 \\ &= 240 \end{aligned}$$

(v) There are 2 vowels and 4 consonants in the word 'VOWELS'.

Considering 4 consonants as one letter, we have 3 letters which can be arranged in ${}^3P_3 = 3!$ ways.

U, W, L, S can be put together in 4! ways.

Hence, required number of words in which all consonants come together $= 3! \times 4!$

$$= 3 \times 2 \times 4 \times 3 \times 2$$
$$= 144.$$

Permutations Ex 16.4 Q8

We have to arrange 7 letters in a row such that vowels occupy even places.

There are 3 even places $(2,4,6)$. Three vowels can be arranged in these 3 even places in 3! ways.

Remaining 4 odd places $(1,3,5,7)$ are to be occupied by the 4 consonants. This can be done in 4! ways.

Hence, the total number of words in which vowels occupy even places $= 3! \times 4!$

$$= 3 \times 2 \times 4 \times 3 \times 2 = 144$$

Permutations Ex 16.4 Q9

Let two husbands A, B be selected out of seven males in = ${}^7C_2$ ways. excluding their wives, we have to select two ladies C, D out of remaining 5 wives is = ${}^5C_2$ ways. Thus, number of ways of selecting the players for mixed double is = ${}^7C_2 \times {}^5C_2$

$$= 21 \times 10$$
$$= 210$$

Now, suppose A chooses C as partner $(B$ will automatically go to $D)$ or

A chooses D as partner $(B$ will automatically go to $C)$

Thus we have, 4 other ways for teams.

Required number of ways = $210 \times 4 = 840$

Permutations Ex 16.4 Q10

m men can be seated in a row in ${}^mP_m = m!$ ways.

Now, in the $(m+1)$ gaps n women can be arranged in ${}^{m+1}P_n$ ways.

Hence, the number of ways in which no two women sit together

$$= m! \times {}^{m+1}P_n$$
$$= m! \times \frac{(m+1)!}{(m+1-n)!}$$
$$= m! \times \frac{(m+1)!}{(m-n+1)!}$$

Hence, proved

Permutations Ex 16.4 Q11

(i) M O N D A Y has 6 letters with no repetitions, so

Number of words using 4 letters at a time with no repetitions = ${}^{6}P_{4}$

$$= \frac{6!}{2!}$$
$$= 360$$

(ii) Number of words using all 6 letters at a time with no repetitions = ${}^{6}P_{6}$

$$= \frac{6!}{(6-6)!}$$
$$= 6 \times 5 \times 4 \times 3 \times 2 \times 1$$
$$= 720$$

(iii) Number of words using all 6 letters, starting with vowels

$$= 2.{}^{5}P_{5}$$
$$= 2 \times 5 \times 4 \times 3 \times 2 \times 1$$
$$= 240$$

Permutations Ex 16.4 Q12

There are 8 letters in the word 'ORIENTAL'. The total number of three letter words is the number of arrangements of 8 items, taken 3 at a time, which is equal to

$${}^{8}P_{3} = \frac{8!}{(8-3)!}$$
$$= \frac{8!}{5!}$$
$$= \frac{8 \times 7 \times 6 \times 5!}{8!}$$
$$= 336.$$