

Permutations 47 (Order is Important)

Examples:

- 1)a) How many ways are there to arrange 7 books on a shelf?
 - b) How many ways are there to arrange 4 of these books on the shelf?
 - c) If three of the seven books are science books and four are math books, how many ways are there to arrange the books on the shelf, if the subjects are to be kept together?
- 2) Find the number of permutations of the letters in the following words.

- a) MATH b) BOOK c) BOOKKEEPER

Answers:

- 1)a) ${}_7P_7 = 7! = 5,040$, b) ${}_7P_4 = 7 \times 6 \times 5 \times 4 = 840$,
- c) ${}_3P_3 \times {}_4P_4 \times 2! = 3! \times 4! \times 2! = 288$
- 2)a) $4 \times 3 \times 2 \times 1 = 24$, b) $4 \times 3 \times 2 \times 1 / 2! = 12$, c) $10! / (2! \times 2! \times 3!) = 151,200$.

Show your reasoning when answering the following problems.

- 1)a) Evaluate: ${}_{99}P_2$ b) Solve for n. $2 \times {}_n P_3 = {}_{n+1} P_3$
- 2) There are 8 runners in a race. How many possibilities are there for; first, second and third place?
- 3) A hat rack has 7 hooks. Four different hats are hung on the rack. How many ways can this be done?
- 4)a) In how many ways can 9 books be arranged on a shelf?

b) If there are 3 math books, 2 science books and 4 English books among these 9 books, how many ways are there to arrange the books, if the books of each subject are to be kept together?

5) How many permutations can be made by using all of the letters in the following words?

a) FLAGS

b) LEECHES

c) HOMOGENEOUS

6)a) Suppose that you have 5 flags of different colors on a pole. How many signals can be made with the 5 flags on a pole?

b) How many signals can be made with 3 of the 5 flags?

c) How many signals can be made with 1, or 2, or 3 of the 5 flags?

d) How many signals can be made using 2 white flags and 3 black flags?

7)a) Suppose that 6 men and 4 women sit on a bench. The men all sit on the left and the women on the right. How many arrangements are there?

b) Suppose that 4 of these men sit on the left and 2 of the women sit on the right. How many arrangements are there?

8) Suppose that 5 men are seated in a row.

a) How many arrangements are there?

b) How many arrangements are there if two of the men must always sit together?

c) How many arrangements are there if these two men must always be apart?

9)a) How many 4 digit numbers can be formed from two 1's and two 2's?

b) How many 4 digit numbers can be formed from any number of 1's and 2's?

10) A computer code requires two different letters and one digit in any order. How many permutations are there?

11) How many permutations can be made from three letters chosen from the word BREED?

Answers: 1)a) $99 \times 98 = 9702$, b) $2 \times n \times (n-1) \times (n-2) = (n+1) \times n \times (n-1)$; $n = 5$, 2) ${}_8P_3 = 336$, 3) ${}_7P_4 = 840$, 4)a) ${}_9P_9 = 362,880$, b) ${}_4P_4 \times {}_3P_3 \times {}_2P_2 \times 3! = 1728$, 5)a) $5! = 120$, b) $7!/3! = 840$, c) $11!/(3! \times 2!) = 3,326,400$, 6)a) ${}_5P_5 = 120$, b) ${}_5P_3 = 60$, c) ${}_5P_1 + {}_5P_2 + {}_5P_3 = 5 + 20 + 60 = 85$, d) $5!/(2! \times 3!) = 10$, 7)a) ${}_6P_6 \times {}_4P_4 = 6! \times 4! = 17,280$, b) ${}_6P_4 \times {}_4P_2 = 4320$, 8)a) $5! = 120$, b) $4! \times 2 = 48$, c) $120 - 48 = 72$, 9)a) $4!/(2! \times 2!) = 6$, b) $2^4 = 16$, 10) $26 \times 25 \times 10 \times 3! = 39,000$, 11) 33.