

## Permutations and Combinations Worksheet

## I. Evaluate the following:

1) $5!$ 120	2) $\frac{10!}{8!}$ 90	3) $\frac{7!}{6!2!}$ 84
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## II. Permutations

- 4) Evaluate: a)  ${}_7P_4$  840      b)  ${}_{10}P_2$  90      c)  ${}_6P_6$  720

5) In how many different ways can 7 floats line up for the homecoming parade.

$$7! \text{ or } {}_7P_7 = 5040$$

6) In how many ways can 4 of 7 different kinds of bushes be planted along a walkway?

$${}_7P_4 = 840$$

7) Four processes are involved in assembling a certain product and they can be performed in any order. The management wants to test each order to determine which is the least time consuming. How many different orders will have to be tested?

$$4! \text{ or } {}_4P_4 = 24$$

8) A club with 10 members is to choose 3 officers- president, vice-president and secretary. If each office is to be held by 1 person and no person can hold more than one office, how many ways can these offices be filled?

$${}_{10}P_3 = 720$$

9) A corporation has 10 members on its board of directors. In how many different ways can it elect a president, vice-president, secretary and treasurer?

$${}_{10}P_4 = 5040$$

10) For a segment of a radio show, a disc jockey can play 7 songs. If there are 13 songs to choose from, in how many ways can this segment be arranged?

$${}_{13}P_7 = 8648640$$

11) Suppose you are asked to list, in order of preference, the three best movies you have seen this year. If you saw 20 movies, in how many ways can the 3 best be chosen and ranked?

$${}_{20}P_3 = 6840$$

12) How many arrangements of 4 letters from the word COMBINE if no letter is used more than once?

$$7! = 5040$$

13) How many distinguishable permutations are possible using the letters of the following words:

a) ATHENS

$$6! = 720$$

c) SUBSTITUTE

$$\frac{10!}{2!3!2!} = 151200$$

b) BASKETBALL

$$\frac{10!}{2!2!2!} = 453600$$

d) ICICLE

$$\frac{6!}{2!2!} = 180$$

14) A roofing company has 8 roofing jobs to complete in the next 2 months.

a) In how many different orders can the roofing jobs be completed?

$$8! \text{ or } {}_8P_8 = 40320$$

b) If 5 of the 8 roofing jobs can be completed by the end of the first month, in how many different ways can the first 5 jobs be selected?

$${}_8P_5 = 6720$$

15) How many vertical arrangements are there of 8 flags if 4 are white, 3 are blue and 1 is red?

$$4 \cdot 3 \cdot 1 = 12$$

### III. Combinations

16) Your friend is having a party and has 15 games to choose from. There is enough time to play 4 games. In how many ways can you choose 4 games to play?

$${}_{15}C_4 = 1365$$

17) There are 20 members in a club. Five people are selected to go to the state conference. In how many ways can the five members be selected?

$${}_{20}C_5 = 15504$$

18) Your English teacher asked you to read 3 novels from a list of 10. In how many ways can you choose which books to read?

$${}_{10}C_3 = 120$$

19) The general manager of a fast-food restaurant chain must select 6 restaurants from 11 for a promotional program. How many possible ways can this selection be done?

$${}_{11}C_6 = 462$$

20) How many ways are there to select 3 bracelets from a box of 20?

$${}_{20}C_3 = 1140$$

21) How many different ways can a theatrical group select 2 musicals and 3 dramas from 11 musicals and 8 dramas?

$${}_{11}C_2 \cdot {}_8C_3 = 3080$$

- 22) In a train yard there are 4 tank cars, 12 boxcars, and 7 flatcars. How many ways can a train be made up consisting of 2 tank cars, 5 boxcars, and 3 flat cars? (Order is not important.)

$$4C_2 \cdot 12C_5 \cdot 7C_3 = 166320$$

- 23) There are 6 women and 5 men interviewing for 4 cashier positions at Walmart.

- a) In how many ways can the 4 positions be filled?

$$11C_4 = 330$$

- b) In how many ways can the positions be filled if all women are hired?

$$6C_4 = 15$$

- c) In how many ways can the positions be filled if 2 women and 2 men are hired?

$$6C_2 \cdot 5C_2 = 150$$

- d) In how many ways can the positions be filled if at least 1 man is hired?

$$1 \text{ man} \rightarrow 5C_1 \cdot 6C_3 = 100 \quad 3 \text{ men} \rightarrow 5C_3 \cdot 6C_1 = 60 \quad \text{Now add them all up! } 315$$

$$2 \text{ men} \rightarrow 5C_2 \cdot 6C_2 = 150 \quad 4 \text{ men} \rightarrow 5C_4 \cdot 6C_0 = 5$$

- 24) Wake-up Cereal comes in 2 types, crispy and crunchy. If a researcher has 10 boxes of each, how many ways can he select 3 boxes of each for a quality control test?

$$10C_3 \cdot 10C_3 = 14400$$

- 25) How many ways can a dinner patron select 3 appetizers and 2 vegetables if there are 6 appetizers and 5 vegetables on the menu?

$$6C_3 \cdot 5C_2 = 200$$

- 26) How many ways can a jury of 6 women and 6 men be selected from 10 women and 12 men?

$$10C_6 \cdot 12C_6 = 194040$$

- 27) The state narcotics bureau must form a 5 member investigative team. If it has 25 agents from which to choose, how many different possible teams can be formed?

$$25C_5 = 53130$$

- 28) In order to conduct an experiment, 4 students are randomly chosen from a class of 20. How many different groups of 4 people are possible?

$${}_{20}C_4 = 4845$$

- 29) There are 10 seniors, 8 juniors, 5 sophomores and 3 freshmen on student council. A committee of 6 members is formed. Determine the number of ways to form this committee given the following conditions:

- a) the committee is chosen at random

$${}_{26}C_6 = 230230$$

- b) the committee must have 3 seniors, 2 juniors and 1 sophomore.

$${}_{10}C_3 \cdot {}_8C_2 \cdot {}_5C_1 = 16800$$

- c) the committee must have 4 seniors and 2 juniors.

$${}_{10}C_4 \cdot {}_8C_2 = 5880$$

- d) the committee must have at least 4 seniors.

$$4 \text{ seniors} \Rightarrow {}_{10}C_4 \cdot {}_{16}C_2 = 25200 \quad 6 \text{ seniors} \Rightarrow {}_{10}C_6 \cdot {}_{16}C_0 = 210$$

$$5 \text{ seniors} \Rightarrow {}_{10}C_5 \cdot {}_{16}C_1 = 4032$$

$$25200 + 4032 + 210 = 29442$$

- IV. Determine whether the problem requires combinations or permutations to find the answer. Then find the answer.

- 30) Eight members of a school marching band are auditioning for 3 drum majors positions. In how many ways can students be chosen to be drum majors?

$${}_8C_3 = 56$$

- 31) Your school yearbook has an editor-in-chief and an assistant editor-in-chief. The staff of the yearbook has 15 students. In how many ways can students be chosen for these 2 positions?

$${}_{15}P_2 = 210$$

- 32) A relay race has 4 runners who run different parts of the race. There are 16 students on your track team. In how many different ways can your coach select students to compete in the race?

$${}_{16}P_4 = 43680$$

- 33) You must take 6 elective classes to meet your graduation requirements for college. There are 12 classes that you are interested in. In how many ways can you select your elective classes?

$${}_{12}C_6 = 924$$