
CPE (SECOND COURSE)

PRACTICE PROBLEMS 0

(Academic Year 2023–2024)

- 1.— Consider a function of n variables $f(x_1, x_2, \dots, x_n)$. How many partial derivatives of order r can be calculated?
-
- 2.— We have 200,000 euros that we want to invest in 4 investment funds. The investments are counted ten thousand by ten thousand euros, and the minimum that can be invested in each of the funds is 20,000, 20,000, 30,000 and 40,000 euros, respectively. How many different investment strategies are there if
- a) we must invest in all the funds?
 - b) we must invest in at least three of the four possible funds?
-
- 3.— There are 10 people in the supermarket checkout line, and you are the last (number 10). To keep you entertained until it is your turn, you ask yourself
- (a) How many groups of 5 can be formed out of 10 people?
 - (b) How many groups with an odd number of components can be formed out of 10 people?
 - (c) How many groups with an arbitrary number of components include yourself?
 - (d) How many include yourself and do not include the gentleman with the pickle jar?
-
- 4.— How many circumferences on a plane pass through at least three of the following points: $(0,0)$, $(0,1)$, $(0,2)$, $(1,0)$, $(1,1)$, $(1,2)$, $(2,0)$, $(2,1)$, $(2,2)$?
-
- 5.— There are four different roads between city A and city B, three roads between B and C, and two roads connecting A directly to C without passing through B.
- (a) How many routes are possible to travel from A to C via B?
 - (b) How many routes are possible to travel from A to C and come back to A?
 - (c) How many routes are possible to travel from A to C and back to A, passing at least once through B?
 - (d) How many routes are possible to travel from A to C and back to A, without using the same road twice?
-
- 6.— We have six books of Calculus in French, eight in English and five in Spanish. How many ways can the books be arranged on a shelf if the books written in the same language must be together?
-
- 7.— A domino piece is a rectangular piece of wood whose top face is divided into two squares. Each of the squares is either blank or contains a number of dots varying from one to six. Prove that there are exactly 28 different pieces in the domino set.
-

8.— Ten people are seated for dinner around a circular table. Configurations in which the relative positions of the people seated at the table coincide are considered the same seating arrangement.

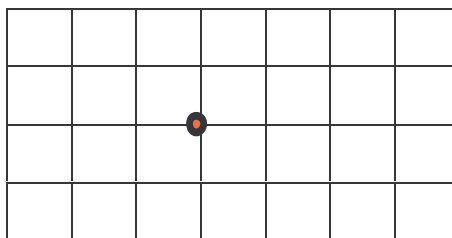
(a) How many ways can they be arranged?

(b) How many ways can they be arranged if we impose that two guests must be seated separately?

9.— Six tennis players from Sildavia have registered for an international tournament. They have to make three teams of two players each to participate in the doubles. How many ways can the teams be arranged?

10.— You live in a neighborhood that can be represented schematically with the following diagram:

B



A

One morning you are about to move from A to B . To do so, you will have to travel at least 11 stretches (a “stretch” is the length of the side of a city block).

(a) How many routes made up of 11 stretches go from A to B ?

(b) How many routes made up of 12 stretches go from A to B ?

(c) If you want to avoid the intersection marked in the diagram (for reasons that are not relevant), how many routes of 11 stretches can you make up?
