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VCE Specialist Mathematics ½

Combinatorics I [5.1]

Test

26.5 Marks. 1 Minute Reading. 27 Minutes Writing.

Results:

Test Questions	_____ / 26.5

$${}^nC_r = \binom{n}{r}$$

Section A: Test Questions (26.5 Marks)

Question 1 (3.5 marks)

Tick whether the following statements are **true** or **false**.

Statement	True	False
a. The multiplication principle states that if there are n ways to perform the first task and m ways to perform the second task, then there are $n \times m$ ways to perform both tasks.		
b. In a permutation, order matters.		
c. Combinations are used when order doesn't matter.		
d. The formula for combinations is $\frac{n!}{r! \times (n-r)!}$.		
e. In combination, the number of subsets of size r that can be chosen from a set of size n is given by ${}^{n}C_{r}$.		
f. The number of ways to choose k objects from a set of n identical objects is ${}^{n}C_{k}$.		
g. The addition principle states that if there are m ways to do one thing and n ways to do another, then there are $m + n$ ways to do both things.		

Space for Personal Notes

Question 2 (1 mark)

An ice cream shop offers 4 types of cones and 6 different flavours of ice cream. How many possible ice cream cone combinations are there?

$4 \cdot 6 = 24$ ways

Space for Personal Notes

Question 3 (4 marks) **Tech-Active.**

a. A teacher wants to randomly choose four people from the class of 20 to help out at the open-day BBQ. In how many ways can this be done? (2 marks)

$^{20}C_4 = 4845$

b. A teacher wants to award prizes for 1^{st}, 2^{nd}, 3^{rd} and 4^{th} in the class of 20. In how many ways can the prizes be awarded (assuming no two students tie)? (2 marks)

$^{20}P_4 = 116280$ ways

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Question 4 (8 marks)

Decide whether or not the order of selection is important, and then write the formula to work out the following:

a. How many different sets of four colours can be selected from the colours red, orange, yellow, green, blue, and violet? (2 marks)

① not

② $^6C_4$

b. In how many ways can a team of female basketball players (5 people) be selected from 9 girls? (2 marks)

① not

② $^9C_5$

c. A race has 24 runners. In how many ways can the first three places be decided? (2 marks)

① yes

② $^{24}P_3$

d. A secretary has eight letters and only five distinct stamps. How many ways can he select the letters for posting? (2 marks)

$^8C_5$

Question 5 (3 marks) **Tech-Active.**

How many arrangements of the letters of the word "~~arrangements~~" are there?

Combinations

$$\frac{12!}{2!2!2!} = 59875200 \text{ ways}$$

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Question 6 (4 marks)

For each of the following, write the answer in factorial notation:

→ assume order doesn't matter

a. In a lottery, you select 8 numbers out of 50. How many ways are there to do this? (2 marks)

$${}^{50}C_8 = \frac{50!}{8!42!}$$

b. A student must select 6 subjects. In how many ways can they do that if there are 20 subjects and 1 is compulsory? (2 marks)

choosing 5 out of 19

$${}^{19}C_5 = \frac{19!}{5!14!}$$

Space for Personal Notes

Question 7 (3 marks)

In how many ways can you choose 3 chocolates from a bag containing 12 different chocolates?

${}^{12}C_3 = 220$ ways

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