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VCE Mathematical Methods ½
Combinations & Permutations [3.3]
Test

32.5 Marks. 1 Minute Reading. 26 Minutes Writing.

Results:








Test Questions	_____ / 32.5
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Section A: Test Questions (32.5 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. In a permutation formula, $(n - r)!$ represents the number of missing arrangements due to missing spots.		
d. Combinations are used when order doesn't matter.		
e. The formula for combinations is $\frac{n!}{r!(n-r)!}$.		
f. Combination is $\frac{nPr}{r!}$ where $r!$ represents the number of different arrangements for the same selection.		
g. The number of ways to choose k objects from a set of n identical objects is nC_k .		

Space for Personal Notes

Question 2 (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 three colours can be selected from the colours red, orange, yellow, green, blue, and violet? (2 marks)

No. 6C_3

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

No. 8C_5

- c. A race has 8 runners. In how many ways can the first three places be decided? (2 marks)

Yes. 8P_3

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

Yes. 9P_5

Question 3 (1 mark)

An ice cream shop offers 3 types of cones and 5 different flavours of ice cream. How many possible ice cream cone combinations are there?

$$\therefore 3 \cdot 5 = 15 \text{ combos}$$

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Question 4 (4 marks)

- a. A teacher wants to randomly choose five people from the class of 30 to help out at the open-day BBQ. In how many ways can this be done? (2 marks)

$$\therefore {}^{30}C_5 = 142,506$$

- b. A teacher wants to award prizes for 1st, 2nd, 3rd, 4th, and 5th in the class of 30. In how many ways can the prizes be awarded (assuming no two students tie)? (2 marks)

$$\therefore {}^{30}P_5 = 17,100,720 //$$

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Question 5 (4 marks)

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

- a. In a lottery, you select 6 numbers out of 40. How many ways are there to do this? (2 marks)

$${}_{40}C_6 = \frac{40!}{6!34!}$$

- b. A student must select 6 subjects. In how many ways can they do that if there are 13 subjects and 1 is compulsory? (2 marks)

$${}_{12}C_5 = \frac{12!}{5!7!}$$

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Question 6 (2 marks)

In how many ways can you choose 2 chocolates from a bag containing 6 different chocolates?

$$= {}^6C_2 = 15 \text{ chocolates}$$

Space for Personal Notes

Question 7 (4 marks)

A bag contains 8 distinct tiles, each labelled with a different letter. The bag contains 3 vowels (A, E, I) and 5 consonants (B, C, D, F, G).

- a. Three tiles are randomly drawn and arranged in a row to form a 3-letter code. (2 marks)

$$\boxed{8} \quad \boxed{7} \quad \boxed{6} = \underline{336 \text{ ways}}$$

$$P(\text{all } v) = 1 \cdot \frac{2}{7} \cdot \frac{1}{6} = \frac{2}{42}$$

- b. If the first letter chosen is a vowel (A, E, I, O, U), what is the probability that the resulting 3-letter code contains at least one consonant? (2 marks)

$$Pr(\geq 1 \text{ consonant}) = 1 - Pr(\text{No consonants})$$

$$Pr(\text{No consonants}) = \frac{2}{42}$$

$$= 1 - \frac{2}{42} = \frac{40}{42} = \frac{20}{21} //$$

Space for Personal Notes

Question 8 (3 marks) Extension.

How many arrangements of the letters of the word “irrigation” are there?

$$\text{IRRIGATION} = \frac{10!}{3!2!}$$

1 2 3 4 5 6 7 8 9 10

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$$\underbrace{CD}_{1} \quad \dots \quad \underbrace{\dots}_{6} = 7! \cdot 2!$$

Question 9 (3 marks) Extension.

A committee of 8 members is seated in a row. Two particular members, Alex and Bella, refuse to sit next to each other, while another two members, Chris and Dana, insist on sitting together.

No. of combos?

$$\underbrace{CD}_{1} \quad \underbrace{AB}_{1} \quad \underbrace{\dots}_{4} = 6! \cdot 2! \cdot 2!$$

No. of total — No. of not wanted

No. of ways C & D together — No. of ways A & B together and C & D together

$$= 7! \cdot 2! - 6! \cdot 2! \cdot 2!$$

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$$= 10,080 - 2880 = 7200 \text{ ways}$$



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