OPTIONAL PURE / MISCELLANEOUS OPTIONAL PURE

Counting, Permutations and Combinations

Questions by topic 10 questions · 79 marks

EXAM BOARDS Edexcel FP2 9FM0/4A

Questions

Question 1	*5 marks*	2
Question 2	*7 marks*	3
Question 3	*7 marks*	4
Question 4	*8 marks*	5
Question 5	*5 marks*	6
Question 6	*7 marks*	7
Question 7	*9 marks*	8
Question 8	*7 marks*	9
Question 9	*12 marks*	10
Question 10	*12 marks*	11

1. A security code consists of four characters, each chosen from the six digits 1, 2, 3, 4, 5, 6 and the three letters P, Q, R.

(a) Find the number of different codes in which no character is repeated and the first character is a letter. **[2]**

(b) Characters may now be repeated. Find the number of different codes that contain at least one letter. **[3]**

2. Each of the 8 letters in the word TATTOOED is printed on a separate card. The cards are arranged in a row.

(a) Find the number of different arrangements of the letters. **[3]**

(b) Find the number of these arrangements in which the three Ts are next to each other and the first letter is not a T. **[4]**

3. A badminton club has 9 adult members and 11 junior members. One of the adults is the club captain, and two of the juniors are twins.
The club must choose a team of 7 players from its members for a tournament.
Find the number of different teams that can be chosen in each of the following cases.

(a) The captain must be in the team. **[1]**

(b) The team must contain exactly 3 adults, and the twins must either both be in the team or both be left out. **[3]**

(c) The team must contain at least 2 adults and at least 2 juniors. **[3]**

4. Three couples and two children are going to the cinema and will sit in a particular row of 8 seats. Find the number of ways in which the eight people can be seated if

(a) there are no restrictions on where they sit in the row, **[1]**

(b) each couple sits together, **[2]**

(c) neither child sits in a seat at either end of the row, **[2]**

(d) each couple sits together and the two children do not sit next to each other. **[3]**

5. A security code consists of 7 characters: 4 **distinct** digits taken from the set $\{1, 2, 3, 4, 5, 6\}$ and 3 letters taken from the set $\{\mathrm{A}, \mathrm{B}, \mathrm{C}, \mathrm{D}, \mathrm{E}\}$.
Letters may be repeated, and the digits and letters may appear in any order within the code.

(a) Find the total number of possible codes. **[2]**

(b) Find the number of codes in which at least two of the letters are next to each other. **[3]**

6. A bag contains 8 discs numbered $1, 2, 3, 4, 5, 6, 7, 8$.
Ben chooses 5 of the discs, without replacement, and places them in a row to form a 5-digit number.

(a) How many of these 5-digit numbers have an even first digit and an even last digit? **[2]**

(b) How many of these 5-digit numbers are odd and less than 35 000? **[5]**

7. The first 25 positive integers include the 9 prime numbers $2, 3, 5, 7, 11, 13, 17, 19$ and 23.
Emma chooses 5 distinct numbers at random from the first 25 positive integers. The order in which Emma chooses the numbers does **not** matter.

(a) Calculate the number of possibilities in which Emma's 5 numbers include exactly 3 prime numbers, none of which is even. **[2]**

(b) Calculate the number of possibilities in which Emma's 5 numbers include more non-prime numbers than prime numbers. **[3]**

(c) Calculate the number of possibilities in which Emma's 5 numbers include at least one pair of prime numbers whose difference is exactly 12. **[4]**

8. Charlie has a set of 150 cards. Each of the integers from 1 to 150 is printed on exactly one of the cards.

(a) Determine how many of Charlie's cards show a number that is **not** a multiple of 3, 5 or 7. **[3]**

Charlie then chooses one or more of the cards and places them side by side in a row, so that reading the digits from left to right gives a single number. Two arrangements are different if they use different cards, or the same cards in a different order.

(b) Determine the number of different arrangements of cards that produce a 4-digit number. **[4]**

9. Numbers are formed using the digits 0, 1, 2 and 3, and no number may begin with the digit 0.

(a) Find the number of different 3-digit numbers that can be formed

(i) if no digit may be used more than once, **[2]**

(ii) if each digit may be used any number of times, **[2]**

(iii) if each digit may be used any number of times and at least one digit appears more than once. **[2]**

(b) Find the number of different **even** 4-digit numbers that can be formed if each digit may be used at most twice. **[6]**

10. A test consists of 5 algebra questions, A, B, C, D and E, and 3 geometry questions, G, H and I. The examiner first plans to arrange all 8 questions in a random order, regardless of topic.

(a) (i) How many different arrangements are possible? **[1]**

(ii) Find the probability that no two geometry questions are next to each other. **[3]**

Later, the examiner decides that the questions should be arranged in two sections, one for each topic. Which section comes first is chosen at random, and the questions within each section are arranged in a random order.

(b) (i) How many different arrangements are now possible? **[2]**

(ii) Find the probability that questions A and B are next to each other. **[2]**

(iii) Find the probability that at least three other questions lie between questions C and H. **[4]**