Additional Mathematics- 0606
Permutation and combinations questions

1)

A musician has to play 4 pieces from a list of 9. Of these 9 pieces 4 were written by Beethoven, 3 by Handel and 2 by Sibelius. Calculate the number of ways the 4 pieces can be chosen if

(i) there are no restrictions, [2]

(ii) there must be 2 pieces by Beethoven, 1 by Handel and 1 by Sibelius, [3]

(iii) there must be at least one piece by each composer. [4]

2)

In a singing competition there are 8 contestants. Each contestant sings in the first round of this competition.

(i) In how many different orders could the contestants sing? [1]

After the first round 5 contestants are chosen.

(ii) In how many different ways can these 5 contestants be chosen? [2]

These 5 contestants sing again and then First, Second and Third prizes are awarded to three of them.

(iii) In how many different ways can the prizes be awarded? [2]

3)

A 4-digit number is formed by using four of the seven digits 2, 3, 4, 5, 6, 7 and 8. No digit can be used more than once in any one number. Find how many different 4-digit numbers can be formed if

(i) there are no restrictions, [2]

(ii) the number is even. [2]

4)

A 4-digit number is formed by using four of the seven digits 1, 3, 4, 5, 7, 8 and 9. No digit can be used more than once in any one number. Find how many different 4-digit numbers can be formed if

(i) there are no restrictions, [2]

(ii) the number is less than 4000, [2]

(iii) the number is even and less than 4000. [2]

5)

A team of 6 members is to be selected from 6 women and 8 men.

(i) Find the number of different teams that can be selected. [1]

(ii) Find the number of different teams that consist of 2 women and 4 men. [3]

(iii) Find the number of different teams that contain no more than 1 woman. [3]

6)

(a) A shelf contains 8 different travel books, of which 5 are about Europe and 3 are about Africa.

(i) Find the number of different ways the books can be arranged if there are no restrictions. [2]

(ii) Find the number of different ways the books can be arranged if the 5 books about Europe are kept together. [2]

(b) 3 DVDs and 2 videotapes are to be selected from a collection of 7 DVDs and 5 videotapes.

Calculate the number of different selections that could be made. [3]

7)

Six-digit numbers are to be formed using the digits 3, 4, 5, 6, 7 and 9. Each digit may only be used once in any number.

(i) Find how many different six-digit numbers can be formed. [1]

Find how many of these six-digit numbers are

(ii) even, [1]

(iii) greater than 500 000, [1]

(iv) even and greater than 500 000. [3]

8)

Four boys and three girls are to be seated in a row. Calculate the number of different ways that this can be done if

(i) the boys and girls sit alternately, [2]

(ii) the boys sit together and the girls sit together, [2]

(iii) a boy sits at each end of the row. [2]

9)

A school council of 6 people is to be chosen from a group of 8 students and 6 teachers. Calculate the number of different ways that the council can be selected if

(i) there are no restrictions, [2]

(ii) there must be at least 1 teacher on the council and more students than teachers. [3]

After the council is chosen, a chairperson and a secretary have to be selected from the 6 council members.

(iii) Calculate the number of different ways in which a chairperson and a secretary can be selected. [1]

10)

(a) Arrangements containing 5 different letters from the word AMPLITUDE are to be made. Find

(i) the number of 5-letter arrangements if there are no restrictions, [1]

(ii) the number of 5-letter arrangements which start with the letter A and end with the letter E. [1]

(b) Tickets for a concert are given out randomly to a class containing 20 students. No student is given more than one ticket. There are 15 tickets.

(i) Find the number of ways in which this can be done. [1]

There are 12 boys and 8 girls in the class. Find the number of different ways in which

(ii) 10 boys and 5 girls get tickets, [3]

(iii) all the boys get tickets. [1]

11)

(a) A team of 7 people is to be chosen from 5 women and 7 men. Calculate the number of different ways in which this can be done if

(i) there are no restrictions, [1]

(ii) the team is to contain more women than men. [3]

(b) **(i)** How many different 4-digit numbers, less than 5000, can be formed using 4 of the 6 digits 1, 2, 3, 4, 5 and 6 if no digit can be used more than once? [2]

(ii) How many of these 4-digit numbers are divisible by 5? [2]

12)

A committee of 7 members is to be selected from 6 women and 9 men. Find the number of different committees that may be selected if

(i) there are no restrictions, [1]

(ii) the committee must consist of 2 women and 5 men, [2]

(iii) the committee must contain at least 1 woman. [3]

13)

A 4-digit number is formed by using four of the six digits 2, 3, 4, 5, 6 and 8; no digit may be used more than once in any number. How many different 4-digit numbers can be formed if

(i) there are no restrictions, [2]

(ii) the number is even and more than 6000? [3]

14)

(a) An art gallery displays 10 paintings in a row. Of these paintings, 5 are by Picasso, 4 by Monet and 1 by Turner.

(i) Find the number of different ways the paintings can be displayed if there are no restrictions. [1]

(ii) Find the number of different ways the paintings can be displayed if the paintings by each of the artists are kept together. [3]

(b) A committee of 4 senior students and 2 junior students is to be selected from a group of 6 senior students and 5 junior students.

(i) Calculate the number of different committees which can be selected. [3]

One of the 6 senior students is a cousin of one of the 5 junior students.

(ii) Calculate the number of different committees which can be selected if at most one of these cousins is included. [3]

15)

A 4-digit number is to be formed from the digits 1, 2, 5, 7, 8 and 9. Each digit may only be used once. Find the number of different 4-digit numbers that can be formed if

(i) there are no restrictions, [1]

(ii) the 4-digit numbers are divisible by 5, [2]

(iii) the 4-digit numbers are divisible by 5 and are greater than 7000. [2]

16)

A committee of 6 members is to be selected from 5 men and 9 women. Find the number of different committees that could be selected if

(i) there are no restrictions, [1]

(ii) there are exactly 3 men and 3 women on the committee, [2]

(iii) there is at least 1 man on the committee. [3]

17)

(a) **(i)** Find how many different 4-digit numbers can be formed from the digits 1, 3, 5, 6, 8 and 9 if each digit may be used only once. [1]

(ii) Find how many of these 4-digit numbers are even. [1]

(b) A team of 6 people is to be selected from 8 men and 4 women. Find the number of different teams that can be selected if

(i) there are no restrictions, [1]

(ii) the team contains all 4 women, [1]

(iii) the team contains at least 4 men. [3]

18)

(a) A 5-character password is to be chosen from the letters A, B, C, D, E and the digits 4, 5, 6, 7. Each letter or digit may be used only once. Find the number of different passwords that can be chosen if

(i) there are no restrictions, [1]

(ii) the password contains 2 letters followed by 3 digits. [2]

(b) A school has 3 concert tickets to give out at random to a class of 18 boys and 15 girls. Find the number of ways in which this can be done if

(i) there are no restrictions, [1]

(ii) 2 of the tickets are given to boys and 1 ticket is given to a girl, [2]

(iii) at least 1 boy gets a ticket. [2]

19)

(a) **(i)** How many different 5-digit numbers can be formed using the digits 1, 2, 4, 5, 7 and 9 if no digit is repeated? [1]

(ii) How many of these numbers are even? [1]

(iii) How many of these numbers are less than 60 000 and even? [3]

(b) How many different groups of 6 children can be chosen from a class of 18 children if the class contains one set of twins who must not be separated? [3]

20)

(a) How many even numbers less than 500 can be formed using the digits 1, 2, 3, 4 and 5? Each digit may be used only once in any number. [4]

(b) A committee of 8 people is to be chosen from 7 men and 5 women. Find the number of different committees that could be selected if

(i) the committee contains at least 3 men and at least 3 women. [4]

(ii) the oldest man or the oldest woman, but not both, must be included in the committee. [2]

21)

(a) **(i)** Find how many different 4-digit numbers can be formed using the digits 1, 2, 3, 4, 5 and 6 if no digit is repeated. [1]

(ii) How many of the 4-digit numbers found in part **(i)** are greater than 6000? [1]

(iii) How many of the 4-digit numbers found in part **(i)** are greater than 6000 and are odd? [1]

(b) A quiz team of 10 players is to be chosen from a class of 8 boys and 12 girls.

(i) Find the number of different teams that can be chosen if the team has to have equal numbers of girls and boys. [3]

(ii) Find the number of different teams that can be chosen if the team has to include the youngest and oldest boy and the youngest and oldest girl. [2]

22)

A committee of four is to be selected from 7 men and 5 women. Find the number of different committees that could be selected if

(i) there are no restrictions, [1]

(ii) there must be two male and two female members. [2]

A brother and sister, Ken and Betty, are among the 7 men and 5 women.

(iii) Find how many different committees of four could be selected so that there are two male and two female members which must include either Ken or Betty but not both. [4]

23)

(a) A security code is to be chosen using 6 of the following:

- the letters A, B and C
- the numbers 2, 3 and 5
- the symbols * and $.

None of the above may be used more than once. Find the number of different security codes that may be chosen if

(i) there are no restrictions, [1]

(ii) the security code starts with a letter and finishes with a symbol, [2]

(iii) the two symbols are next to each other in the security code. [3]

(b) Two teams, each of 4 students, are to be selected from a class of 8 boys and 6 girls. Find the number of different ways the two teams may be selected if

(i) there are no restrictions, [2]

(ii) one team is to contain boys only and the other team is to contain girls only. [2]

24)

(a) A lock can be opened using only the number 4351. State whether this is a permutation or a combination of digits, giving a reason for your answer. [1]

(b) There are twenty numbered balls in a bag. Two of the balls are numbered 0, six are numbered 1, five are numbered 2 and seven are numbered 3, as shown in the table below.

Number on ball	0	1	2	3
Frequency	2	6	5	7

Four of these balls are chosen at random, without replacement. Calculate the number of ways this can be done so that

(i) the four balls all have the same number, [2]

(ii) the four balls all have different numbers, [2]

(iii) the four balls have numbers that total 3. [3]

25)

(a) 6 books are to be chosen from 8 different books.

(i) Find the number of different selections of 6 books that could be made. [1]

A clock is to be displayed on a shelf with 3 of the 8 different books on each side of it. Find the number of ways this can be done if

(ii) there are no restrictions on the choice of books, [1]

(iii) 3 of the 8 books are music books which have to be kept together. [2]

(b) A team of 6 tennis players is to be chosen from 10 tennis players consisting of 7 men and 3 women. Find the number of different teams that could be chosen if the team must include at least 1 woman. [3]

26)

(a) Five different books are to be arranged on a shelf. There are 2 Mathematics books and 3 History books. Find the number of different arrangements of books if

(i) the Mathematics books are next to each other, [2]

(ii) the Mathematics books are not next to each other. [2]

(b) To compete in a quiz, a team of 5 is to be chosen from a group of 9 men and 6 women. Find the number of different teams that can be chosen if

(i) there are no restrictions, [1]

(ii) at least two men must be on the team. [3]

27)

A team of 3 people is to be selected from 7 women and 6 men. Find the number of different teams that could be selected if there must be more women than men on the team. [3]

28)

(a) **(i)** Find how many 5-digit even numbers can be made using each of the digits 1, 2, 3, 4, 5 once only. [2]

(ii) Find how many different 3-digit numbers can be made using the digits 1, 2, 3, 4, 5 if each digit can be used once only. [2]

(b) A man and two women are to sit in a row of five empty chairs. Calculate the number of ways they can be seated if

(i) the two women must sit next to each other, [2]

(ii) all three people must sit next to each other. [2]

29)

Mr and Mrs Coldicott have 5 sons and 4 daughters. All 11 members of the family play tennis. Six members of the family enter a tennis competition where teams consist of 4 males and 2 females.

Find the number of different teams of 4 males and 2 females that could be selected if

(i) there are no further restrictions, [2]

(ii) Mr and Mrs Coldicott must both be in the team, [2]

(iii) either Mr or Mrs Coldicott is in the team but not both. [3]

30)

(a) A team of 5 students is to be chosen from a class of 10 boys and 8 girls. Find the number of different teams that may be chosen if

(i) there are no restrictions, [1]

(ii) the team must contain at least one boy and one girl. [4]

(b) A computer password, which must contain 6 characters, is to be chosen from the following 10 characters:

Symbols	?	!	*	
Numbers	3	5	7	
Letters	W	X	Y	Z

Each character may be used once only in any password. Find the number of possible passwords that may be chosen if

(i) there are no restrictions, [1]

(ii) each password must start with a letter and finish with a number, [2]

(iii) each password must contain at least one symbol. [3]

31)

(a) A 5-digit number is to be formed from the seven digits 1, 2, 3, 5, 6, 8 and 9. Each digit can only be used once in any 5-digit number. Find the number of different 5-digit numbers that can be formed if

(i) there are no restrictions, [1]

(ii) the number is divisible by 5, [1]

(iii) the number is greater than 60 000, [1]

(iv) the number is greater than 60 000 and even. [3]

32)

(a) How many 5-digit numbers are there that have 5 different digits and are divisible by 5? [3]

(b) A committee of 8 people is to be selected from 9 men and 5 women. Find the number of different committees that can be selected if the committee must have at least 4 women. [3]

33)

(a) A football club has 30 players. In how many different ways can a captain and a vice-captain be selected at random from these players? [1]

(b) A team of 11 teachers is to be chosen from 2 mathematics teachers, 5 computing teachers and 9 science teachers. Find the number of different teams that can be chosen if

(i) the team must have exactly 1 mathematics teacher, [2]

(ii) the team must have exactly 1 mathematics teacher and at least 4 computing teachers. [4]

34)

(a) 10 people are to be chosen, to receive concert tickets, from a group of 8 men and 6 women.

(i) Find the number of different ways the 10 people can be chosen if 6 of them are men and 4 of them are women. [2]

The group of 8 men and 6 women contains a man and his wife.

(ii) Find the number of different ways the 10 people can be chosen if both the man and his wife are chosen or neither of them is chosen. [3]

(b) Freddie has forgotten the 6-digit code that he uses to lock his briefcase. He knows that he did not repeat any digit and that he did not start his code with a zero.

(i) Find the number of different 6-digit numbers he could have chosen. [1]

Freddie also remembers that his 6-digit code is divisible by 5.

(ii) Find the number of different 6-digit numbers he could have chosen. [3]

Freddie also remembers that his 6-digit code is divisible by 5.

(ii) Find the number of different 6-digit numbers he could have chosen. [3]

Freddie decides to choose a new 6-digit code for his briefcase once he has opened it. He plans to have the 6-digit number divisible by 2 and greater than 600 000, again with no repetitions of digits.

(iii) Find the number of different 6-digit numbers he can choose. [3]

35)

(a) A 6-digit number is to be formed using the digits 1, 3, 5, 6, 8, 9. Each of these digits may be used only once in any 6-digit number. Find how many different 6-digit numbers can be formed if

(i) there are no restrictions, [1]

(ii) the number formed is even, [1]

(iii) the number formed is even and greater than 300 000. [3]

(b) Ruby wants to have a party for her friends. She can only invite 8 of her 15 friends.

(i) Find the number of different ways she can choose her friends for the party if there are no restrictions. [1]

Two of her 15 friends are twins who cannot be separated.

(ii) Find the number of different ways she can now choose her friends for the party. [3]

36)

Naomi is going on holiday and intends to read 4 books during her time away. She selects these books from 5 mystery, 3 crime and 2 romance books. Find the number of ways in which she can make her selection in each of the following cases.

(i) There are no restrictions. [1]

(ii) She selects at least 2 mystery books. [3]

(iii) She selects at least 1 book of each type. [3]

37)

A 7-character password is to be selected from the 12 characters shown in the table. Each character may be used only once.

	Characters			
Upper-case letters	A	B	C	D
Lower-case letters	e	f	g	h
Digits	1	2	3	4

Find the number of different passwords

(i) if there are no restrictions, [1]

(ii) that start with a digit, [1]

(iii) that contain 4 upper-case letters and 3 lower-case letters such that all the upper-case letters are together and all the lower-case letters are together. [3]

38)

(a) Four parts in a play are to be given to four of the girls chosen from the seven girls in a drama class. Find the number of different ways in which this can be done. [2]

(b) Three singers are chosen at random from a group of 5 Chinese, 4 Indian and 2 British singers. Find the number of different ways in which this can be done if

(i) no Chinese singer is chosen, [1]

(ii) one singer of each nationality is chosen, [2]

(iii) the three singers chosen are all of the same nationality. [2]

39)

A 5-digit code is to be formed from the digits 1, 2, 3, 4, 5, 6, 7, 8, 9. Each digit can be used once only in any code. Find how many codes can be formed if

(i) the first digit of the code is 6 and the other four digits are odd, [2]

(ii) each of the first three digits is even, [2]

(iii) the first and last digits are prime. [2]

40)

(a) A 5-character code is to be formed from the 13 characters shown below. Each character may be used once only in any code.

Letters : A, B, C, D, E, F

Numbers: 1, 2, 3, 4, 5, 6, 7

Find the number of different codes in which no two letters follow each other and no two numbers follow each other. [3]

(b) A netball team of 7 players is to be chosen from 10 girls. 3 of these 10 girls are sisters. Find the number of different ways the team can be chosen if the team does not contain all 3 sisters. [3]

41)

A squad of 20 boys, which includes 2 sets of twins, is available for selection for a cricket team of 11 players. Calculate the number of different teams that can be selected if

(i) there are no restrictions, [1]

(ii) both sets of twins are selected, [2]

(iii) one set of twins is selected but neither twin from the other set is selected, [2]

(iv) exactly one twin from each set of twins is selected. [2]

42)

(a) Eight books are to be arranged on a shelf. There are 4 mathematics books, 3 geography books and 1 French book.

(i) Find the number of different arrangements of the books if there are no restrictions. [1]

(ii) Find the number of different arrangements if the mathematics books have to be kept together. [3]

(iii) Find the number of different arrangements if the mathematics books have to be kept together and the geography books have to be kept together. [3]

(b) A team of 6 players is to be chosen from 8 men and 4 women. Find the number of different ways this can be done if

(i) there are no restrictions, [1]

(ii) there is at least one woman in the team. [2]

43)

(a) Jack has won 7 trophies for sport and wants to arrange them on a shelf. He has 2 trophies for cricket, 4 trophies for football and 1 trophy for swimming. Find the number of different arrangements if

(i) there are no restrictions, [1]

(ii) the football trophies are to be kept together, [3]

(iii) the football trophies are to be kept together and the cricket trophies are to be kept together. [3]

(b) A team of 8 players is to be chosen from 6 girls and 8 boys. Find the number of different ways the team may be chosen if

(i) there are no restrictions, [1]

(ii) all the girls are in the team, [1]

(iii) at least 1 girl is in the team. [2]

44)

(a) Eleven different television sets are to be displayed in a line in a large shop.

(i) Find the number of different ways the televisions can be arranged. [1]

Of these television sets, 6 are made by company *A* and 5 are made by company *B*.

(ii) Find the number of different ways the televisions can be arranged so that no two sets made by company *A* are next to each other. [2]

(b) A group of people is to be selected from 5 women and 3 men.

(i) Calculate the number of different groups of 4 people that have exactly 3 women. [2]

(ii) Calculate the number of different groups of at most 4 people where the number of women is the same as the number of men. [2]

45)

(a) Jess wants to arrange 9 different books on a shelf. There are 4 mathematics books, 3 physics books and 2 chemistry books. Find the number of different possible arrangements of the books if

(i) there are no restrictions, [1]

(ii) a chemistry book is at each end of the shelf, [2]

(iii) all the mathematics books are kept together and all the physics books are kept together. [3]

(b) A quiz team of 6 children is to be chosen from a class of 8 boys and 10 girls. Find the number of ways of choosing the team if

(i) there are no restrictions, [1]

(ii) there are more boys than girls in the team. [4]

46)

A 5-digit code is formed using the following characters.

Letters	a	e	i	o	u	
Numbers	1	2	3	4	5	6
Symbols	@	*	#			

No character can be repeated in a code. Find the number of possible codes if

(i) there are no restrictions, [2]

(ii) the code starts with a symbol followed by two letters and then two numbers, [2]

(iii) the first two characters are numbers, and no other numbers appear in the code. [2]

47)

Nine cards, each of a different colour, are to be arranged in a line.

(i) How many different arrangements of the 9 cards are possible? [1]

The 9 cards include a pink card and a green card.

(ii) How many different arrangements do not have the pink card next to the green card? [3]

Consider all possible choices of 3 cards from the 9 cards with the 3 cards being arranged in a line.

(iii) How many different arrangements in total of 3 cards are possible? [2]

(iv) How many of the arrangements of 3 cards in part **(iii)** contain the pink card? [2]

(v) How many of the arrangements of 3 cards in part **(iii)** do not have the pink card next to the green card? [2]

48)

(a) A 5-digit code is to be chosen from the digits 1, 2, 3, 4, 5, 6, 7, 8 and 9. Each digit may be used once only in any 5-digit code. Find the number of different 5-digit codes that may be chosen if

(i) there are no restrictions, [1]

(ii) the code is divisible by 5, [1]

(iii) the code is even and greater than 70 000. [3]

(b) A team of 6 people is to be chosen from 8 men and 6 women. Find the number of different teams that may be chosen if

(i) there are no restrictions, [1]

(ii) there are no women in the team, [1]

(iii) there are a husband and wife who must not be separated. [3]