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IGCSE
0606
Additional Maths

Permutations and Combinations
Exercise

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Permutations and combinations

Q1 (a) A 6-character password is to be chosen from the following 9 characters:

letters	A	B	E	F
numbers	5	8	9	
symbols	*	$		

Each character may be used only once in any password. Find the number of different 6-character passwords that may be chosen if.

(i) there are no restrictions. ---[1]

(ii) the password consists of 2 letters, 2 numbers and 2 symbols in that order. ---[2]

(iii) the password must start and finish with a symbol. ---[2]

(b) An examination consists of a section 'A', containing 10 short questions, and a section 'B' containing 5 long questions. Candidates are required to answer 6 questions from section A and 3 questions from section B. Find the number of different selections of questions that can be made if:

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

(ii) Candidate must answer the first 2 questions in section A, and the first question in section B. [SP-20|02|Q5] ---[2]

Q2 A group of five people consists of two women, Alice and Betty, and three men, Carl, David and Ed.

(i) Three of those five people are chosen at random to be a chairperson, a treasurer and a secretary. Find the number of ways in which this can be done if the chairperson and treasurer are both men. ---[2]

These five people sit in a row of five chairs. Find the number of different possible seating arrangements if,

(ii) David must sit in the middle. ---[1]

(iii) Alice and Carl must sit together. ---[2]

[M-18|22|Q3]

Q3 (a) The letters of the word THURSDAY are arranged in a straight line. Find the number of different arrangements of these letters if,

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

(ii) the arrangement must start with letter T and end with letter Y. ---[1]

(iii) the second letter in the arrangement must be Y. --[1]

(b) 7 children have to be divided into two groups, one of 4 children and the other 3 children. Given that there are 3 girls and 4 boys, find the number of different ways this can be done if,

(i) there are no restrictions. --[1]

(ii) all the boys are in one group. --[1]

(iii) one boy and one girl are twins and must be in the same group. M-17/12/Q6 --[3]

Q4 (a) A football club has 30 players. In how 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 one mathematics teacher, ---[2]

(ii) the team must have exactly 1 mathematics teacher and at least 4 computing teachers, S-17/21/Q8 ---[4]

Q5 (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]

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Q5 (b) Ranjit has 25 friends of whom 15 are boys and 10 are girls. Ranjit wishes to hold a birthday party, but can invite only 7 friends. Find the number of different ways these 7 friends can be selected if,

(i) there are no restrictions. ---[1]

(ii) only 2 of the 7 friends are boys. ---[1]

(iii) the 25 friends include a boy and his sister who can not be separated ---[3]

S-17/12/28

Q6 (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]

S-17/23/Q5

Q7 (a) 10 people are to 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 his wife are chosen or neither of them 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 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 remember 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]

W-17/11/Q8

Q8 Naomi is going on holiday and intend 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. [W-17/22/Q5] --[3]

Q9 (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) these are no restrictions. ---[1]

(ii) the number formed is even. ---[3]

(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 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. [W-17/13/Q9] ---[3]

Q10 (a) A 6-character password is to be chosen from the following 9 characters,

letters	A	B	E	F
numbers	5	8	9	
Symbols	*	$		

each character may be used only once in any password. Find the number of different 6-character passwords that may be chosen if, (i) these are no restrictions. --[1]

(ii) the password must consists of 2 letters, 2 numbers and 2 symbols, in that order, --[2]

(iii) the password must start and finish with a Symbol. --[2]

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Q10(b) A examination consists of a section A, containing 10 short questions, and a section B, containing 5 long questions. Candidates are required to answer 6 questions from section A and 3 questions from section B. Find the number of different selections of questions that can be made if,

(i) there are no further restrictions. --[2]

(ii) Candidates must answer the first 2 questions in section A and the first question in section B. M-16/12/Q5 --[2]

Q11 (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 only once. --[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]

S-16/21/Q10

Q12 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] S-16/22/Q3

Q13 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]

W-16/21/Q11

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Q14 (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 atleast 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]

W-16/13/Q9

Q15 (a) Jean has nine different flags.

(i) Find the number of different ways in which Jean can choose three flags from her nine flags. --- [1]

(ii) Jean has five flagpoles in a row. She puts one of her nine flags on each flagpole. Calculate the number of different five-flag arrangements she can make. --- [1]

(b) The six digits of the number 738925 are rearranged so that the resulting six-digit number is even. Find the number of different ways this can be done. M-15/22/Q2 --- [2]

Q16 (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 the 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.

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Q16 (b)

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. S-15/21/Q5 -- [3]

Q17 (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, S-15/12/Q5 --[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. S-15/12/Q5 ---[2]

Q18 (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 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 the books. (Continued→) [1]

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Q18 (a) (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 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]

[W-15/11/Q4]

Q19 (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 2 men must be on the team. [W-15/13/Q9] --[3]

Q20 (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. [S-14/11/Q10] --[2]

Q21 (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]

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Q21 (b) How may 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. [S-14/12/Q8] --[3]

Q22 (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 consent 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 to be given to boys and 1 ticket is given to a girl. --[2]

(iii) at least 1 boy gets a ticket. [S-14/13/Q7] --[2]

Q23 (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 4-digit numbers found in part (i) are greater than 6000. --[1]

(iii) How many 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 the oldest boy and the youngest and oldest girl. [W-14/11/Q10] --[2]

Q24 A committee of four is to 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] (Continued →)

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Q24 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 2 female members which must include either Ken or Betty but not both. ---[4]

[W-14|23|Q2]

Q25 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. [S-13|11|Q3] -[3]

Q26 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 number that can be formed if,

(i) there are no restrictions. ---[1]

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

(iii) the four digit numbers are divisible by 5 and are greater than 7000. [S-13|12|Q2] ---[2]

Q27 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, [S-13|13|Q3] ---[3]

Q28(a)(i) Find how many different 4-digit numbers can be formed from the digit 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]

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Q28 (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. [W-13/11/Q7] ---[3]

Q29 (i) Find how many different numbers can be formed using 4 of the digits 1, 2, 3, 4, 5, 6 and 7 if no digit is repeated. --[1]

Find how many of these 4-digit numbers are

(ii) odd --[1]

(iii) odd and less than 3000. [W-13/23/Q2] ---[3]

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Answers

Q1 (a) (i) ${}^9P_6 = 60480$ ✓

(ii) ${}^4P_2 \times {}^3P_2 \times {}^2P_2 = 144$ ✓

(iii) ${}^2P_2 \times {}^7P_4 = 2 \times 840 = 1680$ ✓

(b) (i) ${}^{10}C_6 \times {}^5C_3 = 2100$ ✓

(ii) ${}^8C_4 \times {}^4C_2 = 420$ ✓

Q2 (i) ${}^3P_2 \times {}^3P_1 = 18$ ✓

(ii) $\times\times D\times\times = {}^4P_4 = 24$ ✓

(iii) $2 \times 4! = 48$ ✓

Q3 (a) (i) ${}^8P_8 = 40320$ ✓

(ii) $T\times\times\times\times\times\times Y = {}^6P_6 = 720$ ✓

(iii) $\times Y\times\times\times\times\times\times = {}^7P_7 = 5040$ ✓

(b) (i) ${}^7C_4 \times {}^3C_3 = 35 \times 1 = 35$ ✓

(ii) ${}^4C_4 \times {}^3C_3 = 1 \times 1 = 1$ ✓

(iii) Twins in Grp of four $= {}^5C_2 = 10$
Twins in Grp of 3 $= {}^5C_1 = 5$
∴ Total $= 10 + 5 = 15$ ✓

Q4 (a) ${}^{30}P_2 = 870$ ✓

(b) (i) ${}^2C_1 \times {}^{14}C_{10} = 2 \times 1001 = 2002$ ✓

(ii) $({}^2C_1 \times {}^5C_4 \times {}^9C_6) + ({}^2C_1 \times {}^5C_5 \times {}^9C_5)$
$= 840 + 252 = 1092$ ✓

Q5 (a) (i) ${}^7P_5 = 2520$ ✓

(ii) $\times\times\times\times$ (5 Unit) $= {}^6P_4 = 360$ ✓

(iii) To start with (6 or 8 or 9)
$= 3 \times {}^6P_4 = 3 \times 360 = 1080$ ✓

(iv) To start with 6 or 8
$2 \times 5 \times 4 \times 3 \times 2 = 240$ (Even)
or To start with 9
$1 \times 5 \times 4 \times 3 \times 3 = 180$ (Even (2,6,8))
Total $= 240 + 180 = 420$ ✓

Q5 (b) (i) ${}^{25}C_7 = 480700$ ✓

(ii) ${}^{15}C_2 \times {}^{10}C_5 = 26460$ ✓

(iii) with bro & sis $= {}^{23}C_5 = 33649$ +
without bro & sis $= {}^{23}C_7 = 245157$
∴ Total ways $= 278806$ ✓

Q6 (a) Zero (0) in Unit Place + 5 in Unit
$(9 \times 8 \times 7 \times 6 \times 1) + (8 \times 8 \times 7 \times 6 \times 1)$
$= 5712$ ✓

(b) ${}^9C_4 \times {}^5C_4 + {}^9C_3 \times {}^5C_5 = (630 + 84) = 714$ ✓

Q7 (i) ${}^8C_6 \times {}^6C_4 = 420$ ✓

(ii) ${}^{12}C_8 + {}^{12}C_{10} = 561$ ✓

(b) (i) $9 \times {}^9P_5 = 136080$

(ii) Ending with 0 $= {}^9P_5 = 15120$ +
Ending with 5 $= 8 \times {}^8C_4 \times 1 = 1344$
$= 28560$ ✓

(iii) Starting with 6 or 8 $= 2 \times {}^8P_4 \times 4$ even +
starting with 7 or 9 $= 2 \times {}^8P_4 \times 5$ even
$= 13440 + 16800 = 30,240$ ✓

Q8 (i) ${}^{10}C_4 = 210$ ✓

(ii) 2 Mystery + 2 other $= {}^5C_2 \times {}^5C_2 = 100$
3 Mys + 1 other $= {}^5C_3 \times {}^5C_1 = 50$
4 Mystery $= {}^5C_4 = 5$
Total $= 155$ ✓

(iii) $2M + 1C + 1R = {}^5C_2 \times {}^3C_1 \times {}^2C_1 = 60$
$1M + 2C + 1R = {}^5C_1 \times {}^3C_2 \times {}^2C_1 = 30$
$1M + 1C + 2R = {}^5C_1 \times {}^3C_1 \times {}^2C_2 = 15$
Total $= 105$ ✓

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Answers

Q9 (a)(i) $^6P_6 = 6! = 720$ ✓

(ii) $5! \times 2$ (unit place (6 or 8)) $= 240$ ✓

(iii) $4 \times 4! \times 2$ (6 or 8) $= 192$ ✓

(b)(i) $^{15}C_8 = 6435$ ✓

(ii) with twins $^{13}C_6 = 1716$
without twins $^{13}C_8 = 1287$
Total $= 3003$ ✓

Q10 (a)(i) $^9P_6 = 60480$ ✓

(ii) $^4P_2 \times {^3P_2} \times {^2P_2} = 144$ ✓

(iii) $^2P_2 \times {^7P_4} = 2 \times 840 = 1680$ ✓

(b) (i) $^{10}C_6 \times {^5C_3} = 2100$ ✓

(ii) $^8C_4 \times {^4C_2} = 420$ ✓

Q11 (a)(i) $2 \times 4! = 48$ ✓

(ii) $^5P_3 = 60$ ✓

(b)(i) $4 \times 2! \times 3 = 24$ ✓

(ii) $3! \times 3 = 18$ ✓

Q12 2W + 1M $= {^7C_2} \times {^6C_1} = 126$
all 3W $= {^7C_3} = 35$
Total $= 161$ ✓

Q13 (i) $^6C_4 \times {^5C_2} = 15 \times 10 = 150$ ✓

(ii) $^5C_3 \times {^4C_1} = 10 \times 4 = 40$ ✓

(iii) Mr C and not Mrs C $= {^5C_3} \times {^4C_2} = 60$
Not Mr C and Mrs C $= {^5C_4} \times {^4C_1} = 20$
Total $= 60$ ✓

Q14 (a)(i) $^{18}C_5 = 8568$ ✓

(ii) $^{10}C_4 \times {^8C_1} = 1680$
$^{10}C_3 \times {^8C_2} = 3360$
$^{10}C_2 \times {^8C_3} = 2520$
$^{10}C_1 \times {^8C_4} = 700$
Total $= 8260$ ✓

(b)(i) $^{10}P_6 = 151200$ ✓

(ii) $4 \times {^8P_4} \times 3 = 20160$ ✓

(iii) Ans to (i) $- {^7P_6} = 146160$ ✓ (No symbol)

Q15 (a)(i) $^9C_3 = 84$ ✓

(ii) $^9P_5 = 15120$ ✓

(b) _ _ _ _ _ unit (2 or 8) $= 2 \times 5! = 240$ ✓

Q16 (a) Permutation, because the order matters.

(b)(i) $^6C_4 + {^5C_4} + {^7C_4} = 55$ ✓

(ii) $^2C_1 \times {^6C_1} \times {^5C_1} \times {^7C_1} = 420$ ✓

(iii) $(0,0,1,2) \rightarrow {^2C_2} \times {^6C_1} \times {^5C_1} = 30$
or $(1,1,1,0) \rightarrow {^6C_3} \times {^2C_1} = 40$
Total $= 70$ ✓

Q17 (a)(i) $^8P_6 = 20160$ ✓

(ii) $3 \times {^6P_4} \times 2 = 2160$ ✓

(iii) $5 \times 2 \times {^6P_4} = 3600$ ✓

(b)(i) $^{14}C_4 \times {^{10}C_4} = 210210$ ✓

(ii) $^8C_4 \times {^6C_4} = 1050$ ✓

Q18 (a)(i) $^8C_6 = 28$ ✓

(ii) $^8P_3 \times {^5P_3} = 336 \times 60 = 20160$ ✓

(iii) $3!\,({^5P_3}) \times 2 = 720$ ✓

(b) No restriction − No woman $= {^{10}C_6} - {^7C_6} = 203$ ✓

Permutations and Combinations

Answers

Q19 (a)(i) $21 \times 4! = 48$ ✓

(ii) $5! - 4! = 72$ ✓

(b)(i) $^{15}C_5 = 3003$.

(ii) $3003 - [$No man + One man$]$

$^6C_5 + {}^9C_4 \times {}^6C_4$

$= 3003 - (6 + 135) = 2862$ ✓

Q20 (a) one digit even Nos = 2

2 digit even Nos = $4 \times 2 = 8$

3 digit even Nos = $3 \times 3 \times 2 = 18$

Total = 28 ✓

(b)(i) 3M 5W = $^7C_3 \times {}^5C_5 = 35$

4M 4W = $^7C_4 \times {}^5C_4 = 175$

5M 3W = $^7C_5 \times {}^5C_3 = 210$

Total = 420 ✓

(ii) Oldest man in and Oldest woman out = $^{10}C_7$

and vice versa = $^{10}C_7$

Total = $2 \times {}^{10}C_7 = 240$ ✓

Q21 (a)(i) $^6P_5 = 720$ ✓

(ii) $^5P_4 \times 2 = 240$ ✓

(iii) starts with either a 2 or a 4

$= 2 \times (4 \times 3 \times 2) \times 1 = 48$

starts with 1 or 5 $= 2 \times (4 \times 3 \times 2) \times 2 = 96$

Total $= 48 + 96 = 144$ ✓

(b) with twins $^{16}C_4 = 1820$

without twins $= {}^{16}C_6 = 8008$

Total $= 9828$ ✓

Q22 (a)(i) $^9P_5 = 15120$ ✓

(ii) $(5 \times 4) \times (4 \times 3 \times 2) = 480$ ✓

(b)(i) $^{33}C_3 = 5456$ ✓

(ii) $^{18}C_2 \times {}^{15}C_1 = 2295$

(iii) 5456 − only Girls $= 5456 - {}^{15}C_3$

$= 5456 - 455 = 5001$ ✓

Q23 (a)(i) $^6P_4 = 360$ ✓

(ii) 6 at thousands place $= 1 \times {}^5P_3 = 60$ ✓

(iii) 6 at Thousands Place and 1 or 3, 5 at Unit Place

$= 1 \times {}^4P_2 \times 3 = 36$ ✓

(b)(i) $^8C_5 \times {}^{12}C_5 = 56 \times 792 = 44352$ ✓

(ii) $^{16}C_6 = 8008$ ✓

Q24 (i) $^{12}C_4 = 495$ ✓

(ii) $^7C_2 \times {}^5C_2 = 21 \times 10 = 210$ ✓

(iii) not K and B $= {}^6C_2 \times {}^4C_1 = 15 \times 4 = 60$

K but not B $= {}^6C_4 \times {}^4C_2 = 6 \times 6 = 36$

∴ Total = 96 ✓

Q25 (i) $^{14}C_6 = 3003$ ✓

(ii) $^5C_3 \times {}^9C_3 = 840$ ✓

(iii) $3003 - ($No man$) = 3003 - {}^9C_6$

$= 3003 - 84 = 2919$ ✓

Q26 (i) $^6P_4 = 360$ ✓

(ii) 5 at Unit Place, $^5P_3 \times 1) = 60$ ✓

(iii) 5 at Unit Place and 7, 8, 9 at Thousand $= {}^3P_1 \times {}^4P_2 \times 1$

$= 3 \times 12 = 36$ ✓

Answers

Q27 Same as Question 25.

Q28 (a) (i) $6P_4 = 360$

(ii) 6 or 8 at Unit Place;

$= {}^5P_3 \times 2 = 60 \times 2 = 120$ ✓

(b) (i) ${}^{12}C_6 = 924$ ✓

(ii) ${}^8C_2 \times {}^4C_4 = 28 \times 1 = 28$ ✓

(iii) 4M and 2W $= {}^8C_4 \times {}^4C_2 = 420$

5M and 1W $= {}^8C_5 \times {}^4C_1 = 224$

6M $= {}^8C_6 = 28$

Total = 672 ✓

Q29 (i) $7P_4 = 840$ ✓

(ii) at Unit Place one 7 (1, 3, 5 or 7) $= 6P_3 \times 4$

$= 480$ ✓

(iii) at Thousand Place digit 1 → and at Unit Place 3, 5, 7 / or at Thousand Place digit 2 → and at Unit Place (1, 3, 5, 7)

$1 \times {}^5P_2 \times 3 = 60$

$1 \times {}^5P_2 \times 4 = 80$

Total = 140 ✓