

IB Math AA HL — Topic 1 Permutations & Combinations

Counting Principles · Permutations · Combinations

Difficulty	EASY	MEDIUM	HARD
Questions	10	10	10
Total Marks	30	40	50



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Name: _____ Date: _____
Score: _____/120

Instructions: Answer all questions. Show all working. Give answers correct to 3 significant figures unless stated otherwise. Each question states whether a calculator is permitted.

Key Formulae

Multiplication principle: if task A has m outcomes and task B has n outcomes, the combined count is $m \times n$.

Permutations (order matters): ${}^nP_r = \frac{n!}{(n-r)!}$; arrangements of all n distinct objects: $n!$

Combinations (order irrelevant): ${}^nC_r = \frac{n!}{r!(n-r)!}$

Repeated letters / identical objects: arrange n objects with repeats $r_1, r_2, \dots$: $\frac{n!}{r_1! r_2! \dots}$

Circular arrangements: $(n-1)!$ for labelled positions; halve if reflections are identical: $\frac{(n-1)!}{2}$

Block (objects together): treat block as one unit giving $(n-k+1)!$ arrangements of units, multiply by $k!$ internal arrangements of the block.

Complement for "at least one": (at least one) = (total) – (none)

GDC Tips

Factorials on the TI-84/Casio CG50: enter n , then MATH > PRB > ! (TI) or OPTN > PROB > $x!$ (Casio); use this for large $n!$ rather than expanding by hand.

nP_r and nC_r directly: TI-84: MATH > PRB > nPr / nCr; Casio CG50: OPTN > PROB > P / C. Enter n first, select command, then r .

Solving ${}^nC_r = k$ by integer search: store a formula in Y= (TI) or use TABLE mode (Casio) to list values for integer n , then read off the solution.

Cumulative case counts: use the GDC to evaluate each case separately and sum in the home screen; store intermediate results in variables A, B, ... to avoid re-entry errors.

Probability from counting: compute numerator and denominator as ${}^nC_r / {}^nP_r$ expressions; divide immediately and round to 3 s.f. only at the final step.

Sanity-check with small cases: if time allows, verify your formula by listing outcomes manually for $n = 3$ or $n = 4$ before scaling up.

Common Mistakes to Avoid

- Confusing permutations and combinations.** Always state explicitly whether order matters; failing to do so and then choosing the wrong formula loses both the method and accuracy marks.
- Forgetting to multiply by internal arrangements in block questions.** Treating a block of k objects as one unit but omitting the $k!$ factor for arrangements within the block gives only half the required two-stage structure.
- Incorrect complement calculation.** Writing $1 - P(\text{none})$ without subtracting from the total count (or 1 in probability) leads to a negative or nonsensical answer; always compute total — unwanted.
- Dividing by $r!$ twice for repeated letters.** Applying the combinations formula $\binom{n}{r}$ to a word problem already divided by repeat factorials double-counts the adjustment; use $\frac{n!}{r_1! r_2! \dots}$ directly.
- Using $(n - 1)!$ for linear, not circular, arrangements.** The fix $(n - 1)!$ applies only when objects sit on a circle with no fixed reference point; for a straight line the answer is $n!$.
- Rounding intermediate counts to 3 s.f.** Counts must be exact integers throughout; premature rounding produces wrong totals and loses the accuracy mark even when the method is correct.

Section A — Easy **EASY** (10 questions $\times$ 3 marks = 30 marks)



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1. **EASY** **Calculator** [3 marks]

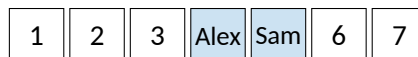
A school timetable committee consists of 4 teachers and 3 students. Find the number of ways of selecting this committee from 9 teachers and 7 students.

2. **EASY** **No Calculator** [3 marks]

Write down the number of ways of arranging the 6 distinct books $B_1, B_2, B_3, B_4, B_5, B_6$ in a row on a shelf.

3. **EASY** **Calculator** [3 marks]

A photographer must arrange 7 people in a row for a photograph. Two of the people, Alex and Sam, must stand next to each other. The diagram shows the 7 seats, with the pair treated as a single block.



Find the number of arrangements.

4. **EASY** **Calculator**

[3 marks]

Find the number of ways of choosing a team of 5 players from a squad of 12, where order of selection does not matter.

5. **EASY** **Calculator**

[3 marks]

A password consists of 3 distinct letters chosen from the 26 letters of the alphabet, followed by 2 distinct digits chosen from $\{0, 1, 2, \dots, 9\}$. The order of both the letters and the digits matters. Find the number of possible passwords.

6. **EASY** **No Calculator**

[3 marks]

Write down the value of $\binom{10}{3} + \binom{10}{4}$ as a single binomial coefficient, justifying your answer using Pascal's identity.

7. **EASY** **Calculator**

[3 marks]

The table shows the number of fiction and non-fiction books available in two languages at a library.

Genre	English	French
Fiction	6	4
Non-fiction	5	3

A reader selects exactly 2 English books and 1 French book. Find the number of ways this selection can be made, given that order does not matter.

8. **EASY** **Calculator**

[3 marks]

Eight people sit around a circular table. Find the number of distinct arrangements, given that rotations are considered identical.

9. **EASY** **No Calculator**

[3 marks]

State the number of ways of arranging the letters of the word PEPPER.

10. **EASY** **Calculator**

[3 marks]

A bag contains 5 red counters and 4 blue counters, all distinct. A child picks 3 counters at random. Find the probability that at least one red counter is chosen, giving your answer correct to 3 significant figures.

Section B — Medium **MEDIUM** (10 questions $\times$ 4 marks = 40 marks)



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11. **MEDIUM** **Calculator** [4 marks]

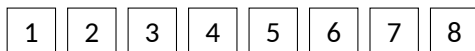
A school committee of 5 members is to be chosen from 6 teachers and 4 students. Find the number of ways the committee can be formed if it must contain at least 2 students.

12. **MEDIUM** **No Calculator** [4 marks]

The letters of the word ARRANGE are written in a row. Find the number of different arrangements of these 7 letters.

13. **MEDIUM** **Calculator** [4 marks]

Eight people, including a married couple (Alex and Blake), are to be seated in a row of 8 chairs. The diagram shows the 8 seats numbered 1 to 8.



Find the number of arrangements in which Alex and Blake are not seated next to each other.

14. **MEDIUM** **Calculator** [4 marks]

A team of 4 players is chosen from a group of 5 boys and 6 girls. The table shows the composition of the group.

Gender	Number available
Boys	5
Girls	6
Total	11

Find the number of ways a team of 4 can be selected so that there are more girls than boys.

15. **MEDIUM** **No Calculator** [4 marks]

Five distinct mathematics books and three distinct science books are to be arranged on a shelf. Find the number of arrangements in which all three science books are kept together.

16. **MEDIUM** **Calculator** [4 marks]

A photographer arranges 7 people in a row for a photograph. Two of the people, Sam and Jo, refuse to stand next to each other. Find the number of valid arrangements.

17. **MEDIUM** **No Calculator** [4 marks]

A club has 10 members. A president, a secretary, and a treasurer are to be chosen from the 10 members, where one person cannot hold more than one role. Find the number of ways these three roles can be filled.

18. **MEDIUM** **Calculator** [4 marks]

A 4-digit code is formed using the digits 1, 2, 3, 4, 5, 6, 7 with no digit repeated. Find the probability that the code is an even number greater than 5000. Give your answer correct to 3 significant figures.

19. **MEDIUM** **Calculator** [4 marks]

The letters of the word STATISTICS are written in a row. Find the number of different arrangements of these 10 letters.

20. **MEDIUM** **Calculator**

[4 marks]

A committee of 6 people is to be chosen from 4 men and 7 women. The committee must include a chairperson, who must be a woman, chosen from the 7 available. The remaining 5 committee members are then chosen from the remaining people (4 men and 6 women) with no further restrictions. Find the total number of ways the committee can be formed.

Section C — Hard **HARD** (10 questions $\times$ 5 marks = 50 marks)



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21. **HARD** **Calculator** [5 marks]

A committee of 5 people is to be chosen from 7 women and 6 men. The committee must contain at least 2 women and at least 1 man. Find the number of ways this committee can be formed.

22. **HARD** **No Calculator** [5 marks]

A shelf holds 4 identical red books, 3 identical blue books, and 2 identical green books, all 9 books in a row. Find the number of distinct arrangements of all 9 books.

23. **HARD** **Calculator** [5 marks]

Eight students, including two named Priya and Quinn, are seated in a circle of 8 seats. Seats are distinguishable only by relative position. Find the number of arrangements in which Priya and Quinn are not adjacent.

24. **HARD** **Calculator** [5 marks]

The digits 1, 2, 3, 4, 5, 6 are each used exactly once to form a 6-digit number n , where $n \in \mathbb{Z}^+$. Find the number of such numbers that are divisible by 4.

25. **HARD** **No Calculator** [5 marks]

A sports club has 5 sprinters, 4 jumpers, and 3 throwers, as shown in the table. A team of 6 athletes is selected. The team must contain at least 2 athletes from each discipline. Show that the number of ways of selecting such a team is 180.

Discipline	Number of athletes
Sprinters	5
Jumpers	4
Throwers	3

26. **HARD** No Calculator

[5 marks]

A password consists of 3 distinct letters chosen from $\{A, B, C, D, E, F\}$ followed by 2 distinct digits chosen from $\{1, 2, 3, 4, 5\}$. The letters are arranged in alphabetical order and the digits are arranged in increasing order. Find the number of possible passwords.

27. **HARD** Calculator

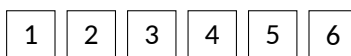
[5 marks]

Ten books, of which 4 are mathematics books, are arranged on a shelf in a row. Find the probability that no two mathematics books are adjacent. Give your answer correct to 3 significant figures.

28. **HARD** Calculator

[5 marks]

Six people, including two married couples (couple A: Arjun and Bina; couple B: Carlos and Dana) and two singles Eli and Fran, are arranged in a row of 6 seats. The diagram shows the 6 seats.



Find the number of arrangements in which both members of couple A sit together and both members of couple B sit together.

29. **HARD** Calculator

[5 marks]

A teacher must assign r students, where $r \in \mathbb{Z}^+$, to give individual presentations from a class of 12 students, where the order of presentations matters. Given that $\binom{12}{r} \times r! = 3 \times \binom{12}{r-1} \times (r-1)!$, find the value of r .

30. **HARD** Calculator

[5 marks]

From a group of 9 distinct objects, k objects are chosen, where $k \in \mathbb{Z}^+$. It is given that $\binom{9}{k} = \binom{9}{k+3}$. Using this result, find the number of ways of choosing k objects from the group when the objects are split into two subgroups of 4 and 5, and exactly 2 objects must come from the subgroup of 4. Justify your answer by stating which counting principle is applied at the final step.

Mark Schemes

Q1 — Committee Selection from Two Groups **EASY**

Order does not matter, so combinations are used.

$$\text{Number of ways} = \binom{9}{4} \times \binom{7}{3} \quad \text{M1}$$

$$= 126 \times 35 \quad \text{A1}$$

$$= 4410 \quad \text{A1}$$

Q2 — Arrangements of Distinct Objects **EASY**

Order matters, so the number of arrangements is $6!$ M1

$$6! = 720 \quad \text{A1}$$

Note: Award M1 for recognising that all $6!$ orderings are distinct.

$$= 720 \quad \text{A1}$$

Q3 — Block Arrangement with Pair Together **EASY**

Treat Alex and Sam as one block: there are 6 units to arrange. M1

$$\text{Number of arrangements of 6 units} = 6! = 720$$

Alex and Sam can swap within the block in $2! = 2$ ways. M1

$$\text{Total} = 720 \times 2 = 1440 \quad \text{A1}$$

Q4 — Combination from a Squad **EASY**

Order does not matter, so combinations are used. M1

$$\text{Number of ways} = \binom{12}{5} \quad \text{A1}$$

$$= 792 \quad \text{A1}$$

Q5 — Password with Ordered Letters and Digits **EASY**

Order matters for both parts, so permutations are used.

$$\text{Number of letter arrangements} = {}^{26}P_3 = 26 \times 25 \times 24 = 15\,600 \quad \text{M1}$$

$$\text{Number of digit arrangements} = {}^{10}P_2 = 10 \times 9 = 90 \quad \text{A1}$$

Total number of passwords = $15\,600 \times 90 = 1\,404\,000$

A1

Q6 — Pascal's Identity Applied **EASY**

Pascal's identity states $\binom{n}{r} + \binom{n}{r+1} = \binom{n+1}{r+1}$.

R1

Applying with $n = 10, r = 3$:

M1

$$\binom{10}{3} + \binom{10}{4} = \binom{11}{4}$$

A1

Q7 — Selection from Grouped Books **EASY**

Order does not matter; selecting 2 English books from $6 + 5 = 11$ and 1 French book from $4 + 3 = 7$.

$$\text{Number of ways to choose 2 English books} = \binom{11}{2} = 55$$

M1

$$\text{Number of ways to choose 1 French book} = \binom{7}{1} = 7$$

A1

$$\text{Total} = 55 \times 7 = 385$$

A1

Q8 — Circular Arrangement of 8 People **EASY**

For circular arrangements, one person is fixed to remove identical rotations.

R1

$$\text{Number of distinct arrangements} = (8 - 1)! = 7!$$

M1

$$7! = 5040$$

A1

Q9 — Word with Repeated Letters **EASY**

PEPPER has 6 letters with P repeated 3 times and E repeated 2 times.

M1

$$\text{Number of arrangements} = \frac{6!}{3!2!}$$

A1

$$= \frac{720}{6 \times 2} = 60$$

A1

Q10 — At Least One Red Counter Probability **EASY**

$$\text{Total number of ways to choose 3 counters from 9: } \binom{9}{3} = 84$$

M1

Using the complement: $P(\text{at least one red}) = 1 - P(\text{no red})$

Number of ways with no red (all blue) $= \binom{4}{3} = 4$

$$P(\text{at least one red}) = 1 - \frac{4}{84} = \frac{80}{84} \approx 0.952380 \dots$$

A1

$= 0.952$ (3 s.f.)

A1

Q11 — At-Least Committee Selection MEDIUM

Using case enumeration; order does not matter so combinations are used.

Cases: exactly 2 students, exactly 3 students, exactly 4 students.

Exactly 2 students: $\binom{4}{2} \binom{6}{3} = 6 \times 20 = 120$

M1

Exactly 3 students: $\binom{4}{3} \binom{6}{2} = 4 \times 15 = 60$

A1

Exactly 4 students: $\binom{4}{4} \binom{6}{1} = 1 \times 6 = 6$

M1

Total $= 120 + 60 + 6 = 186$

A1

Q12 — Repeated-Letter Word Arrangement MEDIUM

The word ARRANGE has 7 letters with A repeated twice and R repeated twice.

Order matters; repeated letters reduce the count so divide by the repeat factorials.

M1

Number of arrangements $= \frac{7!}{2!2!}$

A1

$$= \frac{5040}{4}$$

M1

$$= 1260$$

A1

Q13 — Separation by Complement MEDIUM

Total arrangements of 8 people in a row $= 8! = 40320$

M1

Count arrangements where Alex and Blake are adjacent: treat them as one block giving 7 units; the block has $2!$ internal orders.

Adjacent arrangements $= 7! \times 2 = 5040 \times 2 = 10080$

M1

Arrangements where they are not adjacent $= 40320 - 10080$

A1

$$= 30240$$

A1

Q14 — Group Selection with Composition Condition MEDIUM

More girls than boys in a team of 4 means: 3 girls & 1 boy, or 4 girls & 0 boys.

Order does not matter so combinations are used.

M1

$$3 \text{ girls, 1 boy: } \binom{6}{3} \binom{5}{1} = 20 \times 5 = 100$$

A1

$$4 \text{ girls, 0 boys: } \binom{6}{4} \binom{5}{0} = 15 \times 1 = 15$$

M1

$$\text{Total} = 100 + 15 = 115$$

A1

Q15 — Block Arrangement MEDIUM

Treat the 3 science books as a single block; there are then $5 + 1 = 6$ units to arrange.

The block can be arranged internally in $3!$ ways; the 6 units are arranged in $6!$ ways.

M1

$$\text{Number of arrangements} = 6! \times 3!$$

A1

$$= 720 \times 6$$

M1

$$= 4320$$

A1

Q16 — Separation by Complement MEDIUM

$$\text{Total arrangements of 7 people in a row} = 7! = 5040$$

M1

Count arrangements where Sam and Jo are adjacent: treat them as one block giving 6 units; the block has $2!$ internal orders.

$$\text{Adjacent arrangements} = 6! \times 2 = 720 \times 2 = 1440$$

M1

$$\text{Valid arrangements} = 5040 - 1440$$

A1

$$= 3600$$

A1

Q17 — Committee with Distinguished Roles MEDIUM

Three distinct roles are to be filled from 10 members; order matters because the roles are different, so permutations are used.

M1

$$\text{Number of ways} = {}^{10}P_3 = 10 \times 9 \times 8$$

M1

$$= 720$$

A1A1

Note: Award A1A1 for the correct unsimplified expression and the correct final value.

Q18 — Digit-Number with Divisibility and Size Conditions MEDIUM

Total 4-digit codes with no repeated digits from $\{1, 2, 3, 4, 5, 6, 7\}$: $7 \times 6 \times 5 \times 4 = 840$ **M1**

Favourable: code is even (last digit $\in \{2, 4, 6\}$) AND greater than 5000 (first digit $\in \{5, 6, 7\}$).

Case work by first digit and last digit (must be different digits):

- First digit 5, last digit $\in \{2, 4, 6\}$: $3 \times 5 \times 4 = 60$
- First digit 6, last digit $\in \{2, 4\}$ (not 6): $2 \times 5 \times 4 = 40$
- First digit 7, last digit $\in \{2, 4, 6\}$: $3 \times 5 \times 4 = 60$

Favourable = $60 + 40 + 60 = 160$ **M1**

Probability = $\frac{160}{840} = 0.190476 \dots$ **A1**

= 0.190 (3 s.f.) **A1**

Q19 — Repeated-Letter Word Arrangement MEDIUM

The word STATISTICS has 10 letters: S appears 3 times, T appears 3 times, I appears 2 times, A appears once, C appears once.

Order matters; repeated letters reduce the count so divide by the repeat factorials. **M1**

Number of arrangements = $\frac{10!}{3!3!2!}$ **A1**

GDC: $\frac{3\,628\,800}{6 \times 6 \times 2} = \frac{3\,628\,800}{72}$ **M1**

= 50400 **A1**

Q20 — Committee with Distinguished Role MEDIUM

The chairperson is chosen first; order matters for this selection but not for the remaining 5 places.

Choose chairperson (must be a woman) from 7 women: $\binom{7}{1} = 7$ ways **M1**

Choose remaining 5 committee members from the remaining $4 + 6 = 10$ people: $\binom{10}{5} = 252$ ways **M1**

Total = 7×252 **A1**

= 1764 **A1**

Note: The group is 4 men and 7 women (11 people); the chairperson is one of the 7 women, correctly leaving 4 men and 6 women (10 people) for the remaining selection.

Q21 — Committee with Gender Constraint HARD

Total committee size is 5, from 7 women and 6 men, with ≥ 2 women and ≥ 1 man (so ≤ 4 women).

Valid compositions (women, men): (2, 3), (3, 2), (4, 1). **M1**

$\binom{7}{2} \binom{6}{3} = 21 \times 20 = 420$	A1
$\binom{7}{3} \binom{6}{2} = 35 \times 15 = 525$	A1
$\binom{7}{4} \binom{6}{1} = 35 \times 6 = 210$	A1
Total = $420 + 525 + 210 = 1155$	A1

Q22 — Arrangements with Repeated Letters HARD

Total number of books: $4 + 3 + 2 = 9$. Order matters, so a permutation with repetition is used.	M1
Number of distinct arrangements = $\frac{9!}{4! 3! 2!}$	M1
$= \frac{362880}{24 \times 6 \times 2}$	A1
$= \frac{362880}{288}$	A1
$= 1260$	A1

Q23 — Circular Arrangement Non-Adjacent Pair HARD

Fix one person to remove rotational equivalence; total circular arrangements of 8 people = $7! = 5040$.	M1
Count arrangements where Priya and Quinn are adjacent: treat them as a block, giving 7 units in a circle.	M1
Circular arrangements of 7 units = $6!$; Priya and Quinn can swap within the block: $6! \times 2 = 1440$.	A1
Arrangements where they are not adjacent = $5040 - 1440$	M1
$= 3600$	A1

Q24 — 6-Digit Numbers Divisible by 4 HARD

A number is divisible by 4 if and only if its last two digits form a number divisible by 4.	M1
List all 2-digit endings using distinct digits from $\{1, 2, 3, 4, 5, 6\}$ divisible by 4: 12, 16, 24, 32, 36, 52, 56, 64	A1
<i>Note: Accept any systematic listing giving exactly 8 valid endings.</i>	
There are 8 valid endings.	A1
For each valid ending, the remaining 4 digits from the 6 are arranged in the first 4 positions: $4! = 24$ ways.	M1

$$\text{Total} = 8 \times 24 = 192$$

A1

Q25 — Team with Discipline Constraints Show That **HARD**

Team of 6 with ≥ 2 from each of sprinters (5), jumpers (4), throwers (3). Since $2 + 2 + 2 = 6$, the only valid composition is exactly (2, 2, 2). **M1**

Note: Award M1 for identifying that exactly (2, 2, 2) is the only valid split.

Number of ways to choose 2 sprinters from 5: $\binom{5}{2} = 10$ **A1**

Number of ways to choose 2 jumpers from 4: $\binom{4}{2} = 6$ **A1**

Number of ways to choose 2 throwers from 3: $\binom{3}{2} = 3$ **A1**

By the multiplication principle, total = $10 \times 6 \times 3 = 180$ **AG**

Note: Final line carries no mark as the target is given (AG).

Q26 — Ordered Selections Forming Passwords **HARD**

Since letters must appear in alphabetical order and digits in increasing order, once the subset is chosen the arrangement is determined. **M1**

Number of ways to choose 3 letters from 6 (order fixed by alphabet): $\binom{6}{3}$ **M1**

$\binom{6}{3} = 20$ **A1**

Number of ways to choose 2 digits from 5 (order fixed by size): $\binom{5}{2} = 10$ **A1**

Total passwords = $20 \times 10 = 200$ **A1**

Q27 — Probability No Two Maths Books Adjacent **HARD**

Total arrangements of 10 books: $10!$ **M1**

For no two mathematics books adjacent: arrange the 6 non-mathematics books first ($6!$ ways), creating 7 gaps (including ends). Choose 4 of these 7 gaps for the mathematics books and arrange them: $\binom{7}{4} \times 4!$ **M1**

Favourable arrangements = $6! \times \binom{7}{4} \times 4!$ **A1**

$$\text{Using GDC: } \frac{6! \times \binom{7}{4} \times 4!}{10!} = \frac{720 \times 35 \times 24}{3628800} = \frac{604800}{3628800}$$

$$= 0.166 \dots \approx 0.167 \text{ (3 s.f.)}$$

M1
A1

Q28 — Row Arrangement with Two Couples Together **HARD**

Treat couple A (Arjun and Bina) as one block and couple B (Carlos and Dana) as one block. This gives $2 + 2 = 4$ units: block A, block B, Eli, Fran. **M1**

Number of arrangements of 4 units in a row: $4! = 24$ **A1**

Within block A, Arjun and Bina can be arranged in $2! = 2$ ways. **A1**

Within block B, Carlos and Dana can be arranged in $2! = 2$ ways. **A1**

Total = $4! \times 2! \times 2! = 24 \times 2 \times 2 = 96$ **A1**

Q29 — Solve Equation Involving Permutations **HARD**

Rewrite using ${}^nP_r = \binom{n}{r} \times r!$, so the equation becomes ${}^{12}P_r = 3 \times {}^{12}P_{r-1}$. **M1**

$$\frac{12!}{(12-r)!} = 3 \times \frac{12!}{(12-(r-1))!} = 3 \times \frac{12!}{(13-r)!}$$

M1

Dividing both sides by $\frac{12!}{(13-r)!}$: **M1**

$$(13-r) = 3$$

A1

Note: Accept equivalent GDC search; award A1 for $r = 10$ with valid supporting work.

$$r = 10$$

A1

Q30 — Combination Identity then Split-Group Selection **HARD**

From $\binom{9}{k} = \binom{9}{k+3}$, use the symmetry property $\binom{n}{r} = \binom{n}{n-r}$: **M1**

$\binom{9}{k} = \binom{9}{9-k}$, so $\binom{9}{k} = \binom{9}{k+3}$ requires $k+3 = 9-k$, i.e. $2k = 6$, so $k = 3$. **M1 A1**

Check: $\binom{9}{3} = 84 = \binom{9}{6} = \binom{9}{3+3} \checkmark$, confirming $k = 3$ is the unique valid integer solution.

Choose exactly 2 from the subgroup of 4 and $k-2 = 1$ from the subgroup of 5: $\binom{4}{2} \times \binom{5}{1} = 6 \times 5 = 30$

M1

$= 30$

The multiplication principle (rule of product) is applied, since the two independent choices are combined by multiplying. **A1**

Note: Final A1 requires an explicit justification sentence naming the multiplication principle or rule of product.