

GCSE MATHEMATICS

HIGHER TIER

UNIT 5: PROBABILITY

CORRECTED PUBLICATION EDITION

18 chapters • 216 questions • 4–6 marks • complete worked solutions

Student: _____

Independent publication notice

Independently authored and mapped to WJEC Eduqas GCSE Mathematics C300. Not produced, approved, endorsed by or affiliated with Eduqas or WJEC CBAC Ltd. Eduqas is referenced only to identify curriculum alignment; no exam-board logo or official assessment material is reproduced.

Contents and publication statement

Ch.	Reference and topic
1	HP1 - Frequency outcomes and frequency trees
2	HP2A - Randomness, fairness and equally likely outcomes
3	HP2B - Expected outcomes
4	HP3 - Relative frequency and theoretical probability
5	HP4A - Complements and exhaustive outcomes
6	HP4B - Addition rule and overlap
7	HP5 - Convergence and unbiased experimentation
8	HP6A - Systematic enumeration
9	HP6B - Sets and Venn diagrams
10	HP7 - Theoretical possibility spaces
11	HP8A - Independence and the multiplication rule
12	HP8B - Trees with replacement
13	HP8C - Dependent trees without replacement
14	HP8D - Repeated-event probability
15	HP9A - Conditional probability from tables
16	HP9B - Conditional probability from Venn diagrams
17	HP9C - Conditional probability on trees
18	HP9D - Reverse and algebraic probability

Questions are independently allocated marks, not official Eduqas marks. The companion lesson notebook reuses Questions 1–8 from each chapter; those are not additional unique questions.

HIGHER TIER**UNIT 5 • CHAPTER 1****HP1 - Frequency outcomes and frequency trees****Chapter purpose**

Record, describe and analyse experimental outcomes using tables and frequency trees.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 1 • Method and assessment map

HP1 - Frequency outcomes and frequency trees

Specification focus

Record, describe and analyse experimental outcomes using tables and frequency trees.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 1 • Practice

HP1 - Frequency outcomes and frequency trees • Questions 1-2

Q01 | 4 MARKS

A frequency tree classifies 330 people first as A or not A, then as B or not B. There are 85 in A, 40 in both A and B, and 60 in not A and B. Complete every branch frequency and find $P(A \text{ given } B)$. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A frequency tree classifies 360 people first as A or not A, then as B or not B. There are 88 in A, 43 in both A and B, and 66 in not A and B. Complete every branch frequency and find $P(A \text{ given } B)$. Your solution must justify the main method or assumption and include a final check.

Chapter 1 • Practice

HP1 - Frequency outcomes and frequency trees • Questions 3-4

Q03 | 4 MARKS

A frequency tree classifies 390 people first as A or not A, then as B or not B. There are 91 in A, 26 in both A and B, and 32 in not A and B. Complete every branch frequency and find $P(A \text{ given } B)$. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A frequency tree classifies 420 people first as A or not A, then as B or not B. There are 94 in A, 29 in both A and B, and 38 in not A and B. Complete every branch frequency and find $P(A \text{ given } B)$. Your solution must justify the main method or assumption and include a final check.

Chapter 1 • Practice

HP1 - Frequency outcomes and frequency trees • Questions 5-6

Q05 | 4 MARKS

A frequency tree classifies 450 people first as A or not A, then as B or not B. There are 97 in A, 32 in both A and B, and 44 in not A and B. Complete every branch frequency and find $P(A \text{ given } B)$. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A frequency tree classifies 480 people first as A or not A, then as B or not B. There are 100 in A, 35 in both A and B, and 50 in not A and B. Complete every branch frequency and find $P(A \text{ given } B)$.

Chapter 1 • Practice

HP1 - Frequency outcomes and frequency trees • Questions 7-8

Q07 | 4 MARKS

A frequency tree classifies 510 people first as A or not A, then as B or not B. There are 103 in A, 38 in both A and B, and 56 in not A and B. Complete every branch frequency and find $P(A \text{ given } B)$.

Q08 | 4 MARKS

A frequency tree classifies 540 people first as A or not A, then as B or not B. There are 106 in A, 41 in both A and B, and 62 in not A and B. Complete every branch frequency and find $P(A \text{ given } B)$.

Chapter 1 • Practice

HP1 - Frequency outcomes and frequency trees • Questions 9-10

Q09 | 4 MARKS

A frequency tree classifies 570 people first as A or not A, then as B or not B. There are 109 in A, 44 in both A and B, and 68 in not A and B. Complete every branch frequency and find $P(A \text{ given } B)$.

Q10 | 4 MARKS

A frequency tree classifies 600 people first as A or not A, then as B or not B. There are 72 in A, 27 in both A and B, and 34 in not A and B. Complete every branch frequency and find $P(A \text{ given } B)$. Your solution must justify the main method or assumption and include a final check.

Chapter 1 • Practice

HP1 - Frequency outcomes and frequency trees • Questions 11-12

Q11 | 5 MARKS

You must show your working. A frequency tree classifies 610 people first as A or not A, then as B or not B. There are 73 in A, 28 in both A and B, and 36 in not A and B. Complete every branch frequency and find $P(A \text{ given } B)$. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A frequency tree classifies 620 people first as A or not A, then as B or not B. There are 74 in A, 29 in both A and B, and 38 in not A and B. Complete every branch frequency and find $P(A \text{ given } B)$. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 1

HP1 - Frequency outcomes and frequency trees • Questions 1-2

Q01 | 4 MARKS

A and not B = $85 - 40 = 45$. Not A = $330 - 85 = 245$; not A and not B = $245 - 60 = 185$. Total B = $40 + 60 = 100$. Therefore $P(\text{A given B}) = 40/100 = 2/5$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

A and not B = $88 - 43 = 45$. Not A = $360 - 88 = 272$; not A and not B = $272 - 66 = 206$. Total B = $43 + 66 = 109$. Therefore $P(\text{A given B}) = 43/109 = 43/109$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 1

HP1 - Frequency outcomes and frequency trees • Questions 3-4

Q03 | 4 MARKS

A and not B = $91 - 26 = 65$. Not A = $390 - 91 = 299$; not A and not B = $299 - 32 = 267$. Total B = $26 + 32 = 58$. Therefore $P(\text{A given B}) = \frac{26}{58} = \frac{13}{29}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

A and not B = $94 - 29 = 65$. Not A = $420 - 94 = 326$; not A and not B = $326 - 38 = 288$. Total B = $29 + 38 = 67$. Therefore $P(\text{A given B}) = \frac{29}{67} = \frac{29}{67}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 1

HP1 - Frequency outcomes and frequency trees • Questions 5-6

Q05 | 4 MARKS

A and not B = $97 - 32 = 65$. Not A = $450 - 97 = 353$; not A and not B = $353 - 44 = 309$. Total B = $32 + 44 = 76$. Therefore $P(\text{A given B}) = 32/76 = 8/19$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

A and not B = $100 - 35 = 65$. Not A = $480 - 100 = 380$; not A and not B = $380 - 50 = 330$. Total B = $35 + 50 = 85$. Therefore $P(\text{A given B}) = 35/85 = 7/17$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 1

HP1 - Frequency outcomes and frequency trees • Questions 7-8

Q07 | 4 MARKS

A and not B = $103 - 38 = 65$. Not A = $510 - 103 = 407$; not A and not B = $407 - 56 = 351$. Total B = $38 + 56 = 94$. Therefore $P(\text{A given B}) = \frac{38}{94} = \frac{19}{47}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

A and not B = $106 - 41 = 65$. Not A = $540 - 106 = 434$; not A and not B = $434 - 62 = 372$. Total B = $41 + 62 = 103$. Therefore $P(\text{A given B}) = \frac{41}{103} = \frac{41}{103}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 1

HP1 - Frequency outcomes and frequency trees • Questions 9-10

Q09 | 4 MARKS

A and not B = $109 - 44 = 65$. Not A = $570 - 109 = 461$; not A and not B = $461 - 68 = 393$. Total B = $44 + 68 = 112$. Therefore $P(\text{A given B}) = \frac{44}{112} = \frac{11}{28}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

A and not B = $72 - 27 = 45$. Not A = $600 - 72 = 528$; not A and not B = $528 - 34 = 494$. Total B = $27 + 34 = 61$. Therefore $P(\text{A given B}) = \frac{27}{61} = \frac{27}{61}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 1

HP1 - Frequency outcomes and frequency trees • Questions 11-12

Q11 | 5 MARKS

A and not B = $73 - 28 = 45$. Not A = $610 - 73 = 537$; not A and not B = $537 - 36 = 501$. Total B = $28 + 36 = 64$. Therefore $P(\text{A given B}) = 28/64 = 7/16$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

A and not B = $74 - 29 = 45$. Not A = $620 - 74 = 546$; not A and not B = $546 - 38 = 508$. Total B = $29 + 38 = 67$. Therefore $P(\text{A given B}) = 29/67 = 29/67$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 1 • Completion and retest record

HP1 - Frequency outcomes and frequency trees

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 2****HP2A - Randomness, fairness and equally likely outcomes****Chapter purpose**

Evaluate mechanisms and calculate outcomes when events are or are not equally likely.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 2 • Method and assessment map

HP2A - Randomness, fairness and equally likely outcomes

Specification focus

Evaluate mechanisms and calculate outcomes when events are or are not equally likely.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 2 • Practice

HP2A - Randomness, fairness and equally likely outcomes • Questions 1-2

Q01 | 4 MARKS

A spinner has 14 equal sectors: 5 red, 5 blue and 4 green. A game pays a prize for red. Find the theoretical probability of winning, compare it with $\frac{1}{3}$, and state one precise redesign that keeps all 5 red sectors but makes winning and losing equally likely. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A spinner has 9 equal sectors: 2 red, 4 blue and 3 green. A game pays a prize for red. Find the theoretical probability of winning, compare it with $\frac{1}{3}$, and state one precise redesign that keeps all 2 red sectors but makes winning and losing equally likely. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HP2A - Randomness, fairness and equally likely outcomes • Questions 3-4

Q03 | 4 MARKS

A spinner has 10 equal sectors: 5 red, 3 blue and 2 green. A game pays a prize for red. Find the theoretical probability of winning, compare it with $\frac{1}{3}$, and state one precise redesign that keeps all 5 red sectors but makes winning and losing equally likely. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A spinner has 12 equal sectors: 2 red, 9 blue and 1 green. A game pays a prize for red. Find the theoretical probability of winning, compare it with $\frac{1}{3}$, and state one precise redesign that keeps all 2 red sectors but makes winning and losing equally likely. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HP2A - Randomness, fairness and equally likely outcomes • Questions 5-6

Q05 | 4 MARKS

A spinner has 17 equal sectors: 5 red, 8 blue and 4 green. A game pays a prize for red. Find the theoretical probability of winning, compare it with $\frac{1}{3}$, and state one precise redesign that keeps all 5 red sectors but makes winning and losing equally likely. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A spinner has 12 equal sectors: 2 red, 7 blue and 3 green. A game pays a prize for red. Find the theoretical probability of winning, compare it with $\frac{1}{3}$, and state one precise redesign that keeps all 2 red sectors but makes winning and losing equally likely. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HP2A - Randomness, fairness and equally likely outcomes • Questions 7-8

Q07 | 4 MARKS

A spinner has 13 equal sectors: 5 red, 6 blue and 2 green. A game pays a prize for red. Find the theoretical probability of winning, compare it with $\frac{1}{3}$, and state one precise redesign that keeps all 5 red sectors but makes winning and losing equally likely. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A spinner has 8 equal sectors: 2 red, 5 blue and 1 green. A game pays a prize for red. Find the theoretical probability of winning, compare it with $\frac{1}{3}$, and state one precise redesign that keeps all 2 red sectors but makes winning and losing equally likely. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HP2A - Randomness, fairness and equally likely outcomes • Questions 9-10

Q09 | 4 MARKS

A spinner has 13 equal sectors: 5 red, 4 blue and 4 green. A game pays a prize for red. Find the theoretical probability of winning, compare it with $\frac{1}{3}$, and state one precise redesign that keeps all 5 red sectors but makes winning and losing equally likely. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

A spinner has 8 equal sectors: 2 red, 3 blue and 3 green. A game pays a prize for red. Find the theoretical probability of winning, compare it with $\frac{1}{3}$, and state one precise redesign that keeps all 2 red sectors but makes winning and losing equally likely. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HP2A - Randomness, fairness and equally likely outcomes • Questions 11-12

Q11 | 5 MARKS

You must show your working. A spinner has 12 equal sectors: 3 red, 5 blue and 4 green. A game pays a prize for red. Find the theoretical probability of winning, compare it with $\frac{1}{3}$, and state one precise redesign that keeps all 3 red sectors but makes winning and losing equally likely. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A spinner has 12 equal sectors: 4 red, 7 blue and 1 green. A game pays a prize for red. Find the theoretical probability of winning, compare it with $\frac{1}{3}$, and state one precise redesign that keeps all 4 red sectors but makes winning and losing equally likely. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 2

HP2A - Randomness, fairness and equally likely outcomes • Questions 1-2

Q01 | 4 MARKS

$P(\text{win}) = 5/14 = 5/14$. It is greater than $1/3$. Keeping 5 winning sectors requires exactly 5 losing sectors, so remove 4 losing sector(s). The redesigned spinner then has 10 equal sectors and $P(\text{win}) = 5/10 = 1/2$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

$P(\text{win}) = 2/9 = 2/9$. It is less than $1/3$. Keeping 2 winning sectors requires exactly 2 losing sectors, so remove 5 losing sector(s). The redesigned spinner then has 4 equal sectors and $P(\text{win}) = 2/4 = 1/2$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 2

HP2A - Randomness, fairness and equally likely outcomes • Questions 3-4

Q03 | 4 MARKS

$P(\text{win}) = 5/10 = 1/2$. It is greater than $1/3$. Keeping 5 winning sectors requires exactly 5 losing sectors, so make no change. The redesigned spinner then has 10 equal sectors and $P(\text{win}) = 5/10 = 1/2$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

$P(\text{win}) = 2/12 = 1/6$. It is less than $1/3$. Keeping 2 winning sectors requires exactly 2 losing sectors, so remove 8 losing sector(s). The redesigned spinner then has 4 equal sectors and $P(\text{win}) = 2/4 = 1/2$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 2

HP2A - Randomness, fairness and equally likely outcomes • Questions 5-6

Q05 | 4 MARKS

$P(\text{win}) = 5/17 = 5/17$. It is less than $1/3$. Keeping 5 winning sectors requires exactly 5 losing sectors, so remove 7 losing sector(s). The redesigned spinner then has 10 equal sectors and $P(\text{win}) = 5/10 = 1/2$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

$P(\text{win}) = 2/12 = 1/6$. It is less than $1/3$. Keeping 2 winning sectors requires exactly 2 losing sectors, so remove 8 losing sector(s). The redesigned spinner then has 4 equal sectors and $P(\text{win}) = 2/4 = 1/2$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 2

HP2A - Randomness, fairness and equally likely outcomes • Questions 7-8

Q07 | 4 MARKS

$P(\text{win}) = 5/13 = 5/13$. It is greater than $1/3$. Keeping 5 winning sectors requires exactly 5 losing sectors, so remove 3 losing sector(s). The redesigned spinner then has 10 equal sectors and $P(\text{win}) = 5/10 = 1/2$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

$P(\text{win}) = 2/8 = 1/4$. It is less than $1/3$. Keeping 2 winning sectors requires exactly 2 losing sectors, so remove 4 losing sector(s). The redesigned spinner then has 4 equal sectors and $P(\text{win}) = 2/4 = 1/2$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 2

HP2A - Randomness, fairness and equally likely outcomes • Questions 9-10

Q09 | 4 MARKS

$P(\text{win}) = 5/13 = 5/13$. It is greater than $1/3$. Keeping 5 winning sectors requires exactly 5 losing sectors, so remove 3 losing sector(s). The redesigned spinner then has 10 equal sectors and $P(\text{win}) = 5/10 = 1/2$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

$P(\text{win}) = 2/8 = 1/4$. It is less than $1/3$. Keeping 2 winning sectors requires exactly 2 losing sectors, so remove 4 losing sector(s). The redesigned spinner then has 4 equal sectors and $P(\text{win}) = 2/4 = 1/2$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 2

HP2A - Randomness, fairness and equally likely outcomes • Questions 11-12

Q11 | 5 MARKS

$P(\text{win}) = 3/12 = 1/4$. It is less than $1/3$. Keeping 3 winning sectors requires exactly 3 losing sectors, so remove 6 losing sector(s). The redesigned spinner then has 6 equal sectors and $P(\text{win}) = 3/6 = 1/2$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

$P(\text{win}) = 4/12 = 1/3$. It is equal than $1/3$. Keeping 4 winning sectors requires exactly 4 losing sectors, so remove 4 losing sector(s). The redesigned spinner then has 8 equal sectors and $P(\text{win}) = 4/8 = 1/2$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 2 • Completion and retest record

HP2A - Randomness, fairness and equally likely outcomes

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 3****HP2B - Expected outcomes****Chapter purpose**

Scale probabilities to expected frequencies and assess the limitations of predictions.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.

Questions 9–12 provide the chapter stretch sequence.

Chapter 3 • Method and assessment map

HP2B - Expected outcomes

Specification focus

Scale probabilities to expected frequencies and assess the limitations of predictions.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 3 • Practice

HP2B - Expected outcomes • Questions 1-2

Q01 | 4 MARKS

A quality model gives probability $\frac{1}{2}$ that an item needs reworking. For 1000 items, calculate the expected number needing rework. The observed number is 498; compare observation with expectation and give a cautious conclusion. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A quality model gives probability $\frac{1}{5}$ that an item needs reworking. For 1150 items, calculate the expected number needing rework. The observed number is 231; compare observation with expectation and give a cautious conclusion. Your solution must justify the main method or assumption and include a final check.

Chapter 3 • Practice

HP2B - Expected outcomes • Questions 3-4

Q03 | 4 MARKS

A quality model gives probability $\frac{1}{2}$ that an item needs reworking. For 1300 items, calculate the expected number needing rework. The observed number is 647; compare observation with expectation and give a cautious conclusion. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A quality model gives probability $\frac{1}{5}$ that an item needs reworking. For 1450 items, calculate the expected number needing rework. The observed number is 290; compare observation with expectation and give a cautious conclusion. Your solution must justify the main method or assumption and include a final check.

Chapter 3 • Practice

HP2B - Expected outcomes • Questions 5-6

Q05 | 4 MARKS

A quality model gives probability $\frac{1}{2}$ that an item needs reworking. For 1600 items, calculate the expected number needing rework. The observed number is 803; compare observation with expectation and give a cautious conclusion. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A quality model gives probability $\frac{1}{5}$ that an item needs reworking. For 1750 items, calculate the expected number needing rework. The observed number is 349; compare observation with expectation and give a cautious conclusion. Your solution must justify the main method or assumption and include a final check.

Chapter 3 • Practice

HP2B - Expected outcomes • Questions 7-8

Q07 | 4 MARKS

A quality model gives probability $\frac{1}{2}$ that an item needs reworking. For 1900 items, calculate the expected number needing rework. The observed number is 952; compare observation with expectation and give a cautious conclusion. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A quality model gives probability $\frac{1}{5}$ that an item needs reworking. For 2050 items, calculate the expected number needing rework. The observed number is 408; compare observation with expectation and give a cautious conclusion. Your solution must justify the main method or assumption and include a final check.

Chapter 3 • Practice

HP2B - Expected outcomes • Questions 9-10

Q09 | 4 MARKS

A quality model gives probability $\frac{1}{2}$ that an item needs reworking. For 2200 items, calculate the expected number needing rework. The observed number is 1101; compare observation with expectation and give a cautious conclusion. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

A quality model gives probability $\frac{1}{5}$ that an item needs reworking. For 2350 items, calculate the expected number needing rework. The observed number is 467; compare observation with expectation and give a cautious conclusion. Your solution must justify the main method or assumption and include a final check.

Chapter 3 • Practice

HP2B - Expected outcomes • Questions 11-12

Q11 | 5 MARKS

You must show your working. A quality model gives probability $\frac{3}{10}$ that an item needs reworking. For 2400 items, calculate the expected number needing rework. The observed number is 718; compare observation with expectation and give a cautious conclusion. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A quality model gives probability $\frac{2}{5}$ that an item needs reworking. For 2450 items, calculate the expected number needing rework. The observed number is 979; compare observation with expectation and give a cautious conclusion. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 3

HP2B - Expected outcomes • Questions 1-2

Q01 | 4 MARKS

Expected frequency = $1000 \times \frac{1}{2} = 500$. The difference is $498 - 500 = -2$. This sample is below the model expectation, but ordinary random variation means one result alone is insufficient to reject the model. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

Expected frequency = $1150 \times \frac{1}{5} = 230$. The difference is $231 - 230 = 1$. This sample is above the model expectation, but ordinary random variation means one result alone is insufficient to reject the model. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 3

HP2B - Expected outcomes • Questions 3-4

Q03 | 4 MARKS

Expected frequency = $1300 \times \frac{1}{2} = 650$. The difference is $647 - 650 = -3$. This sample is below the model expectation, but ordinary random variation means one result alone is insufficient to reject the model. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

Expected frequency = $1450 \times \frac{1}{5} = 290$. The difference is $290 - 290 = 0$. This sample is equal to the model expectation, but ordinary random variation means one result alone is insufficient to reject the model. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 3

HP2B - Expected outcomes • Questions 5-6

Q05 | 4 MARKS

Expected frequency = $1600 \times 1/2 = 800$. The difference is $803 - 800 = 3$. This sample is above the model expectation, but ordinary random variation means one result alone is insufficient to reject the model. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

Expected frequency = $1750 \times 1/5 = 350$. The difference is $349 - 350 = -1$. This sample is below the model expectation, but ordinary random variation means one result alone is insufficient to reject the model. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 3

HP2B - Expected outcomes • Questions 7-8

Q07 | 4 MARKS

Expected frequency = $1900 \times 1/2 = 950$. The difference is $952 - 950 = 2$. This sample is above the model expectation, but ordinary random variation means one result alone is insufficient to reject the model. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

Expected frequency = $2050 \times 1/5 = 410$. The difference is $408 - 410 = -2$. This sample is below the model expectation, but ordinary random variation means one result alone is insufficient to reject the model. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 3

HP2B - Expected outcomes • Questions 9-10

Q09 | 4 MARKS

Expected frequency = $2200 \times 1/2 = 1100$. The difference is $1101 - 1100 = 1$. This sample is above the model expectation, but ordinary random variation means one result alone is insufficient to reject the model. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

Expected frequency = $2350 \times 1/5 = 470$. The difference is $467 - 470 = -3$. This sample is below the model expectation, but ordinary random variation means one result alone is insufficient to reject the model. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 3

HP2B - Expected outcomes • Questions 11-12

Q11 | 5 MARKS

Expected frequency = $2400 \times 3/10 = 720$. The difference is $718 - 720 = -2$. This sample is below the model expectation, but ordinary random variation means one result alone is insufficient to reject the model. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

Expected frequency = $2450 \times 2/5 = 980$. The difference is $979 - 980 = -1$. This sample is below the model expectation, but ordinary random variation means one result alone is insufficient to reject the model. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 3 • Completion and retest record

HP2B - Expected outcomes

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 4****HP3 - Relative frequency and theoretical probability****Chapter purpose**

Relate experimental relative frequencies to theoretical probabilities using precise probability language.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 4 • Method and assessment map

HP3 - Relative frequency and theoretical probability

Specification focus

Relate experimental relative frequencies to theoretical probabilities using precise probability language.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 4 • Practice

HP3 - Relative frequency and theoretical probability • Questions 1-2

Q01 | 4 MARKS

An event occurred 74 times in 230 trials and 327 times in a later set of 920 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

An event occurred 91 times in 260 trials and 364 times in a later set of 1040 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Your solution must justify the main method or assumption and include a final check.

Chapter 4 • Practice

HP3 - Relative frequency and theoretical probability • Questions 3-4

Q03 | 4 MARKS

An event occurred 96 times in 290 trials and 400 times in a later set of 1160 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

An event occurred 115 times in 320 trials and 435 times in a later set of 1280 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Your solution must justify the main method or assumption and include a final check.

Chapter 4 • Practice

HP3 - Relative frequency and theoretical probability • Questions 5-6

Q05 | 4 MARKS

An event occurred 119 times in 350 trials and 497 times in a later set of 1400 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

An event occurred 122 times in 380 trials and 532 times in a later set of 1520 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Your solution must justify the main method or assumption and include a final check.

Chapter 4 • Practice

HP3 - Relative frequency and theoretical probability • Questions 7-8

Q07 | 4 MARKS

An event occurred 144 times in 410 trials and 566 times in a later set of 1640 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

An event occurred 145 times in 440 trials and 598 times in a later set of 1760 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Your solution must justify the main method or assumption and include a final check.

Chapter 4 • Practice

HP3 - Relative frequency and theoretical probability • Questions 9-10

Q09 | 4 MARKS

An event occurred 169 times in 470 trials and 667 times in a later set of 1880 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

An event occurred 170 times in 500 trials and 700 times in a later set of 2000 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Your solution must justify the main method or assumption and include a final check.

Chapter 4 • Practice

HP3 - Relative frequency and theoretical probability • Questions 11-12

Q11 | 5 MARKS

You must show your working. An event occurred 178 times in 510 trials and 724 times in a later set of 2040 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. An event occurred 187 times in 520 trials and 707 times in a later set of 2080 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 4

HP3 - Relative frequency and theoretical probability • Questions 1-2

Q01 | 4 MARKS

First relative frequency = $74/230 = 0.3217$. Second = $327/920 = 0.3554$. The difference is 0.0337. The second estimate is normally more reliable because it is based on 920 trials, although neither guarantees the true probability. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

First relative frequency = $91/260 = 0.3500$. Second = $364/1040 = 0.3500$. The difference is 0.0000. The second estimate is normally more reliable because it is based on 1040 trials, although neither guarantees the true probability. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 4

HP3 - Relative frequency and theoretical probability • Questions 3-4

Q03 | 4 MARKS

First relative frequency= $96/290=0.3310$. Second= $400/1160=0.3448$. The difference is 0.0138. The second estimate is normally more reliable because it is based on 1160 trials, although neither guarantees the true probability. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

First relative frequency= $115/320=0.3594$. Second= $435/1280=0.3398$. The difference is 0.0195. The second estimate is normally more reliable because it is based on 1280 trials, although neither guarantees the true probability. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 4

HP3 - Relative frequency and theoretical probability • Questions 5-6

Q05 | 4 MARKS

First relative frequency= $119/350=0.3400$. Second= $497/1400=0.3550$. The difference is 0.0150. The second estimate is normally more reliable because it is based on 1400 trials, although neither guarantees the true probability. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

First relative frequency= $122/380=0.3211$. Second= $532/1520=0.3500$. The difference is 0.0289. The second estimate is normally more reliable because it is based on 1520 trials, although neither guarantees the true probability. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 4

HP3 - Relative frequency and theoretical probability • Questions 7-8

Q07 | 4 MARKS

First relative frequency= $144/410=0.3512$. Second= $566/1640=0.3451$. The difference is 0.0061. The second estimate is normally more reliable because it is based on 1640 trials, although neither guarantees the true probability. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

First relative frequency= $145/440=0.3295$. Second= $598/1760=0.3398$. The difference is 0.0102. The second estimate is normally more reliable because it is based on 1760 trials, although neither guarantees the true probability. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 4

HP3 - Relative frequency and theoretical probability • Questions 9-10

Q09 | 4 MARKS

First relative frequency= $169/470=0.3596$. Second= $667/1880=0.3548$. The difference is 0.0048. The second estimate is normally more reliable because it is based on 1880 trials, although neither guarantees the true probability. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

First relative frequency= $170/500=0.3400$. Second= $700/2000=0.3500$. The difference is 0.0100. The second estimate is normally more reliable because it is based on 2000 trials, although neither guarantees the true probability. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 4

HP3 - Relative frequency and theoretical probability • Questions 11-12

Q11 | 5 MARKS

First relative frequency= $178/510=0.3490$. Second= $724/2040=0.3549$. The difference is 0.0059. The second estimate is normally more reliable because it is based on 2040 trials, although neither guarantees the true probability. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

First relative frequency= $187/520=0.3596$. Second= $707/2080=0.3399$. The difference is 0.0197. The second estimate is normally more reliable because it is based on 2080 trials, although neither guarantees the true probability. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 4 • Completion and retest record

HP3 - Relative frequency and theoretical probability

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 5****HP4A - Complements and exhaustive outcomes****Chapter purpose**

Use complements and the fact that exhaustive probabilities sum to one.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 5 • Method and assessment map

HP4A - Complements and exhaustive outcomes

Specification focus

Use complements and the fact that exhaustive probabilities sum to one.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 5 • Practice

HP4A - Complements and exhaustive outcomes • Questions 1-2

Q01 | 4 MARKS

Events A and B are mutually exclusive. $P(A)=1/2$ and $P(B)=1/10$. Find $P(A \text{ or } B)$, $P(\text{neither A nor B})$, and explain why all four values lie on the probability scale. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Events A and B are mutually exclusive. $P(A)=1/5$ and $P(B)=1/5$. Find $P(A \text{ or } B)$, $P(\text{neither A nor B})$, and explain why all four values lie on the probability scale. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HP4A - Complements and exhaustive outcomes • Questions 3-4

Q03 | 4 MARKS

Events A and B are mutually exclusive. $P(A)=1/2$ and $P(B)=3/10$. Find $P(A \text{ or } B)$, $P(\text{neither A nor B})$, and explain why all four values lie on the probability scale. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Events A and B are mutually exclusive. $P(A)=1/5$ and $P(B)=2/5$. Find $P(A \text{ or } B)$, $P(\text{neither A nor B})$, and explain why all four values lie on the probability scale. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HP4A - Complements and exhaustive outcomes • Questions 5-6

Q05 | 4 MARKS

Events A and B are mutually exclusive. $P(A)=1/2$ and $P(B)=1/2$. Find $P(A \text{ or } B)$, $P(\text{neither A nor B})$, and explain why all four values lie on the probability scale. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Events A and B are mutually exclusive. $P(A)=1/5$ and $P(B)=1/10$. Find $P(A \text{ or } B)$, $P(\text{neither A nor B})$, and explain why all four values lie on the probability scale. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HP4A - Complements and exhaustive outcomes • Questions 7-8

Q07 | 4 MARKS

Events A and B are mutually exclusive. $P(A)=1/2$ and $P(B)=1/5$. Find $P(A \text{ or } B)$, $P(\text{neither A nor B})$, and explain why all four values lie on the probability scale. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Events A and B are mutually exclusive. $P(A)=1/5$ and $P(B)=3/10$. Find $P(A \text{ or } B)$, $P(\text{neither A nor B})$, and explain why all four values lie on the probability scale. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HP4A - Complements and exhaustive outcomes • Questions 9-10

Q09 | 4 MARKS

Events A and B are mutually exclusive. $P(A)=1/2$ and $P(B)=2/5$. Find $P(A \text{ or } B)$, $P(\text{neither A nor B})$, and explain why all four values lie on the probability scale. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

Events A and B are mutually exclusive. $P(A)=1/5$ and $P(B)=1/2$. Find $P(A \text{ or } B)$, $P(\text{neither A nor B})$, and explain why all four values lie on the probability scale. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HP4A - Complements and exhaustive outcomes • Questions 11-12

Q11 | 5 MARKS

You must show your working. Events A and B are mutually exclusive. $P(A)=3/10$ and $P(B)=1/5$. Find $P(A \text{ or } B)$, $P(\text{neither A nor B})$, and explain why all four values lie on the probability scale. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. Events A and B are mutually exclusive. $P(A)=2/5$ and $P(B)=2/5$. Find $P(A \text{ or } B)$, $P(\text{neither A nor B})$, and explain why all four values lie on the probability scale. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 5

HP4A - Complements and exhaustive outcomes • Questions 1-2

Q01 | 4 MARKS

For mutually exclusive events, $P(A \text{ or } B) = 1/2 + 1/10 = 3/5$. The complement is $1 - 3/5 = 2/5$. Each probability is between 0 and 1, and the event plus its complement totals 1. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

For mutually exclusive events, $P(A \text{ or } B) = 1/5 + 1/5 = 2/5$. The complement is $1 - 2/5 = 3/5$. Each probability is between 0 and 1, and the event plus its complement totals 1. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 5

HP4A - Complements and exhaustive outcomes • Questions 3-4

Q03 | 4 MARKS

For mutually exclusive events, $P(A \text{ or } B) = 1/2 + 3/10 = 4/5$. The complement is $1 - 4/5 = 1/5$. Each probability is between 0 and 1, and the event plus its complement totals 1. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

For mutually exclusive events, $P(A \text{ or } B) = 1/5 + 2/5 = 3/5$. The complement is $1 - 3/5 = 2/5$. Each probability is between 0 and 1, and the event plus its complement totals 1. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 5

HP4A - Complements and exhaustive outcomes • Questions 5–6

Q05 | 4 MARKS

For mutually exclusive events, $P(A \text{ or } B) = 1/2 + 1/2 = 1$. The complement is $1 - 1 = 0$. Each probability is between 0 and 1, and the event plus its complement totals 1. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

For mutually exclusive events, $P(A \text{ or } B) = 1/5 + 1/10 = 3/10$. The complement is $1 - 3/10 = 7/10$. Each probability is between 0 and 1, and the event plus its complement totals 1. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 5

HP4A - Complements and exhaustive outcomes • Questions 7-8

Q07 | 4 MARKS

For mutually exclusive events, $P(A \text{ or } B) = 1/2 + 1/5 = 7/10$. The complement is $1 - 7/10 = 3/10$. Each probability is between 0 and 1, and the event plus its complement totals 1. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

For mutually exclusive events, $P(A \text{ or } B) = 1/5 + 3/10 = 1/2$. The complement is $1 - 1/2 = 1/2$. Each probability is between 0 and 1, and the event plus its complement totals 1. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 5

HP4A - Complements and exhaustive outcomes • Questions 9-10

Q09 | 4 MARKS

For mutually exclusive events, $P(A \text{ or } B) = 1/2 + 2/5 = 9/10$. The complement is $1 - 9/10 = 1/10$. Each probability is between 0 and 1, and the event plus its complement totals 1. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

For mutually exclusive events, $P(A \text{ or } B) = 1/5 + 1/2 = 7/10$. The complement is $1 - 7/10 = 3/10$. Each probability is between 0 and 1, and the event plus its complement totals 1. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 5

HP4A - Complements and exhaustive outcomes • Questions 11-12

Q11 | 5 MARKS

For mutually exclusive events, $P(A \text{ or } B) = 3/10 + 1/5 = 1/2$. The complement is $1 - 1/2 = 1/2$. Each probability is between 0 and 1, and the event plus its complement totals 1. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

For mutually exclusive events, $P(A \text{ or } B) = 2/5 + 2/5 = 4/5$. The complement is $1 - 4/5 = 1/5$. Each probability is between 0 and 1, and the event plus its complement totals 1. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 5 • Completion and retest record

HP4A - Complements and exhaustive outcomes

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 6****HP4B - Addition rule and overlap****Chapter purpose**

Use mutually exclusive cases and the general addition rule with an intersection correction.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 6 • Method and assessment map

HP4B - Addition rule and overlap

Specification focus

Use mutually exclusive cases and the general addition rule with an intersection correction.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 6 • Practice

HP4B - Addition rule and overlap • Questions 1-2

Q01 | 4 MARKS

$P(A)=7/10$, $P(B)=1/2$ and $P(A \text{ intersection } B)=1/5$. Find $P(A \text{ union } B)$, $P(\text{neither})$, and decide with justification whether A and B are mutually exclusive. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

$P(A)=3/5$, $P(B)=3/10$ and $P(A \text{ intersection } B)=1/10$. Find $P(A \text{ union } B)$, $P(\text{neither})$, and decide with justification whether A and B are mutually exclusive. Your solution must justify the main method or assumption and include a final check.

Chapter 6 • Practice

HP4B - Addition rule and overlap • Questions 3-4

Q03 | 4 MARKS

$P(A)=1/2$, $P(B)=1/2$ and $P(A \text{ intersection } B)=1/10$. Find $P(A \text{ union } B)$, $P(\text{neither})$, and decide with justification whether A and B are mutually exclusive. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

$P(A)=2/5$, $P(B)=3/10$ and $P(A \text{ intersection } B)=1/10$. Find $P(A \text{ union } B)$, $P(\text{neither})$, and decide with justification whether A and B are mutually exclusive. Your solution must justify the main method or assumption and include a final check.

Chapter 6 • Practice

HP4B - Addition rule and overlap • Questions 5-6

Q05 | 4 MARKS

$P(A)=7/10$, $P(B)=1/2$ and $P(A \text{ intersection } B)=1/5$. Find $P(A \text{ union } B)$, $P(\text{neither})$, and decide with justification whether A and B are mutually exclusive. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Q06 | 4 MARKS

$P(A)=3/5$, $P(B)=3/10$ and $P(A \text{ intersection } B)=1/10$. Find $P(A \text{ union } B)$, $P(\text{neither})$, and decide with justification whether A and B are mutually exclusive. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Chapter 6 • Practice

HP4B - Addition rule and overlap • Questions 7-8

Q07 | 4 MARKS

$P(A)=1/2$, $P(B)=1/2$ and $P(A \text{ intersection } B)=1/10$. Find $P(A \text{ union } B)$, $P(\text{neither})$, and decide with justification whether A and B are mutually exclusive. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Q08 | 4 MARKS

$P(A)=2/5$, $P(B)=3/10$ and $P(A \text{ intersection } B)=1/10$. Find $P(A \text{ union } B)$, $P(\text{neither})$, and decide with justification whether A and B are mutually exclusive. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Chapter 6 • Practice

HP4B - Addition rule and overlap • Questions 9-10

Q09 | 4 MARKS

$P(A)=7/10$, $P(B)=1/2$ and $P(A \text{ intersection } B)=1/5$. Find $P(A \text{ union } B)$, $P(\text{neither})$, and decide with justification whether A and B are mutually exclusive. Your solution must justify the main method or assumption and include a final check. Identify the key condition you used and explain why it applies here.

Q10 | 4 MARKS

$P(A)=3/5$, $P(B)=3/10$ and $P(A \text{ intersection } B)=1/10$. Find $P(A \text{ union } B)$, $P(\text{neither})$, and decide with justification whether A and B are mutually exclusive. Your solution must justify the main method or assumption and include a final check. Identify the key condition you used and explain why it applies here.

Chapter 6 • Practice

HP4B - Addition rule and overlap • Questions 11-12

Q11 | 5 MARKS

You must show your working. $P(A)=7/10$, $P(B)=1/2$ and $P(A \text{ intersection } B)=1/5$. Find $P(A \text{ union } B)$, $P(\text{neither})$, and decide with justification whether A and B are mutually exclusive. Your solution must justify the main method or assumption and include a final check. Write one sentence interpreting your answer in the context of the question.

Q12 | 6 MARKS

You must show your working. $P(A)=2/5$, $P(B)=3/10$ and $P(A \text{ intersection } B)=3/10$. Find $P(A \text{ union } B)$, $P(\text{neither})$, and decide with justification whether A and B are mutually exclusive. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 6

HP4B - Addition rule and overlap • Questions 1-2

Q01 | 4 MARKS

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 7/10 + 1/2 - 1/5 = 1$. $P(\text{neither}) = 1 - 1 = 0$. They are not mutually exclusive because $P(A \cap B) = 1/5$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 3/5 + 3/10 - 1/10 = 4/5$. $P(\text{neither}) = 1 - 4/5 = 1/5$. They are not mutually exclusive because $P(A \cap B) = 1/10$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 6

HP4B - Addition rule and overlap • Questions 3-4

Q03 | 4 MARKS

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 1/2 + 1/2 - 1/10 = 9/10$. $P(\text{neither}) = 1 - 9/10 = 1/10$. They are not mutually exclusive because $P(A \cap B) = 1/10$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 2/5 + 3/10 - 1/10 = 3/5$. $P(\text{neither}) = 1 - 3/5 = 2/5$. They are not mutually exclusive because $P(A \cap B) = 1/10$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 6

HP4B - Addition rule and overlap • Questions 5-6

Q05 | 4 MARKS

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 7/10 + 1/2 - 1/5 = 1$. $P(\text{neither}) = 1 - 1 = 0$. They are not mutually exclusive because $P(A \cap B) = 1/5$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 3/5 + 3/10 - 1/10 = 4/5$. $P(\text{neither}) = 1 - 4/5 = 1/5$. They are not mutually exclusive because $P(A \cap B) = 1/10$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 6

HP4B - Addition rule and overlap • Questions 7-8

Q07 | 4 MARKS

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 1/2 + 1/2 - 1/10 = 9/10$. $P(\text{neither}) = 1 - 9/10 = 1/10$. They are not mutually exclusive because $P(A \cap B) = 1/10$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 2/5 + 3/10 - 1/10 = 3/5$. $P(\text{neither}) = 1 - 3/5 = 2/5$. They are not mutually exclusive because $P(A \cap B) = 1/10$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 6

HP4B - Addition rule and overlap • Questions 9-10

Q09 | 4 MARKS

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 7/10 + 1/2 - 1/5 = 1$. $P(\text{neither}) = 1 - 1 = 0$. They are not mutually exclusive because $P(A \cap B) = 1/5$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The explanation must name the relevant condition and link it explicitly to the method used.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 3/5 + 3/10 - 1/10 = 4/5$. $P(\text{neither}) = 1 - 4/5 = 1/5$. They are not mutually exclusive because $P(A \cap B) = 1/10$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The explanation must name the relevant condition and link it explicitly to the method used.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 6

HP4B - Addition rule and overlap • Questions 11-12

Q11 | 5 MARKS

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 7/10 + 1/2 - 1/5 = 1$. $P(\text{neither}) = 1 - 1 = 0$. They are not mutually exclusive because $P(A \cap B) = 1/5$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The interpretation should include the correct units or geometric/statistical meaning where applicable.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 2/5 + 3/10 - 3/10 = 2/5$. $P(\text{neither}) = 1 - 2/5 = 3/5$. They are not mutually exclusive because $P(A \cap B) = 3/10$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 6 • Completion and retest record

HP4B - Addition rule and overlap

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 7****HP5 - Convergence and unbiased experimentation****Chapter purpose**

Explain how empirical distributions tend towards theoretical probabilities as sample size increases.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 7 • Method and assessment map

HP5 - Convergence and unbiased experimentation

Specification focus

Explain how empirical distributions tend towards theoretical probabilities as sample size increases.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 7 • Practice

HP5 - Convergence and unbiased experimentation • Questions 1-2

Q01 | 4 MARKS

An event occurred 74 times in 230 trials and 327 times in a later set of 920 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Compare two sample sizes and explain which estimate should usually be more stable.

Q02 | 4 MARKS

An event occurred 91 times in 260 trials and 364 times in a later set of 1040 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Compare two sample sizes and explain which estimate should usually be more stable.

Chapter 7 • Practice

HP5 - Convergence and unbiased experimentation • Questions 3-4

Q03 | 4 MARKS

An event occurred 96 times in 290 trials and 400 times in a later set of 1160 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Compare two sample sizes and explain which estimate should usually be more stable.

Q04 | 4 MARKS

An event occurred 115 times in 320 trials and 435 times in a later set of 1280 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Compare two sample sizes and explain which estimate should usually be more stable.

Chapter 7 • Practice

HP5 - Convergence and unbiased experimentation • Questions 5-6

Q05 | 4 MARKS

An event occurred 119 times in 350 trials and 497 times in a later set of 1400 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Compare two sample sizes and explain which estimate should usually be more stable.

Q06 | 4 MARKS

An event occurred 122 times in 380 trials and 532 times in a later set of 1520 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Compare two sample sizes and explain which estimate should usually be more stable.

Chapter 7 • Practice

HP5 - Convergence and unbiased experimentation • Questions 7-8

Q07 | 4 MARKS

An event occurred 144 times in 410 trials and 566 times in a later set of 1640 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Compare two sample sizes and explain which estimate should usually be more stable.

Q08 | 4 MARKS

An event occurred 145 times in 440 trials and 598 times in a later set of 1760 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Compare two sample sizes and explain which estimate should usually be more stable.

Chapter 7 • Practice

HP5 - Convergence and unbiased experimentation • Questions 9-10

Q09 | 4 MARKS

An event occurred 169 times in 470 trials and 667 times in a later set of 1880 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Compare two sample sizes and explain which estimate should usually be more stable.

Q10 | 4 MARKS

An event occurred 170 times in 500 trials and 700 times in a later set of 2000 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Compare two sample sizes and explain which estimate should usually be more stable.

Chapter 7 • Practice

HP5 - Convergence and unbiased experimentation • Questions 11-12

Q11 | 5 MARKS

You must show your working. An event occurred 178 times in 510 trials and 724 times in a later set of 2040 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Compare two sample sizes and explain which estimate should usually be more stable.

Q12 | 6 MARKS

You must show your working. An event occurred 187 times in 520 trials and 707 times in a later set of 2080 trials. Calculate both relative frequencies, compare them, and decide which is the more reliable estimate of the long-run probability. Compare two sample sizes and explain which estimate should usually be more stable.

Worked solutions • Chapter 7

HP5 - Convergence and unbiased experimentation • Questions 1-2

Q01 | 4 MARKS

First relative frequency= $74/230=0.3217$. Second= $327/920=0.3554$. The difference is 0.0337. The second estimate is normally more reliable because it is based on 920 trials, although neither guarantees the true probability. The conclusion must refer to reduced relative variation rather than claiming certainty. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

First relative frequency= $91/260=0.3500$. Second= $364/1040=0.3500$. The difference is 0.0000. The second estimate is normally more reliable because it is based on 1040 trials, although neither guarantees the true probability. The conclusion must refer to reduced relative variation rather than claiming certainty. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 7

HP5 - Convergence and unbiased experimentation • Questions 3-4

Q03 | 4 MARKS

First relative frequency= $96/290=0.3310$. Second= $400/1160=0.3448$. The difference is 0.0138. The second estimate is normally more reliable because it is based on 1160 trials, although neither guarantees the true probability. The conclusion must refer to reduced relative variation rather than claiming certainty. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

First relative frequency= $115/320=0.3594$. Second= $435/1280=0.3398$. The difference is 0.0195. The second estimate is normally more reliable because it is based on 1280 trials, although neither guarantees the true probability. The conclusion must refer to reduced relative variation rather than claiming certainty. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 7

HP5 - Convergence and unbiased experimentation • Questions 5-6

Q05 | 4 MARKS

First relative frequency= $119/350=0.3400$. Second= $497/1400=0.3550$. The difference is 0.0150. The second estimate is normally more reliable because it is based on 1400 trials, although neither guarantees the true probability. The conclusion must refer to reduced relative variation rather than claiming certainty. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

First relative frequency= $122/380=0.3211$. Second= $532/1520=0.3500$. The difference is 0.0289. The second estimate is normally more reliable because it is based on 1520 trials, although neither guarantees the true probability. The conclusion must refer to reduced relative variation rather than claiming certainty. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 7

HP5 - Convergence and unbiased experimentation • Questions 7-8

Q07 | 4 MARKS

First relative frequency= $144/410=0.3512$. Second= $566/1640=0.3451$. The difference is 0.0061. The second estimate is normally more reliable because it is based on 1640 trials, although neither guarantees the true probability. The conclusion must refer to reduced relative variation rather than claiming certainty. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

First relative frequency= $145/440=0.3295$. Second= $598/1760=0.3398$. The difference is 0.0102. The second estimate is normally more reliable because it is based on 1760 trials, although neither guarantees the true probability. The conclusion must refer to reduced relative variation rather than claiming certainty. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 7

HP5 - Convergence and unbiased experimentation • Questions 9-10

Q09 | 4 MARKS

First relative frequency= $169/470=0.3596$. Second= $667/1880=0.3548$. The difference is 0.0048. The second estimate is normally more reliable because it is based on 1880 trials, although neither guarantees the true probability. The conclusion must refer to reduced relative variation rather than claiming certainty. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

First relative frequency= $170/500=0.3400$. Second= $700/2000=0.3500$. The difference is 0.0100. The second estimate is normally more reliable because it is based on 2000 trials, although neither guarantees the true probability. The conclusion must refer to reduced relative variation rather than claiming certainty. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 7

HP5 - Convergence and unbiased experimentation • Questions 11-12

Q11 | 5 MARKS

First relative frequency= $178/510=0.3490$. Second= $724/2040=0.3549$. The difference is 0.0059. The second estimate is normally more reliable because it is based on 2040 trials, although neither guarantees the true probability. The conclusion must refer to reduced relative variation rather than claiming certainty. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

First relative frequency= $187/520=0.3596$. Second= $707/2080=0.3399$. The difference is 0.0197. The second estimate is normally more reliable because it is based on 2080 trials, although neither guarantees the true probability. The conclusion must refer to reduced relative variation rather than claiming certainty. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 7 • Completion and retest record

HP5 - Convergence and unbiased experimentation

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 8****HP6A - Systematic enumeration****Chapter purpose**

List sets and combinations completely using structured strategies and the product rule.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 8 • Method and assessment map

HP6A - Systematic enumeration

Specification focus

List sets and combinations completely using structured strategies and the product rule.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 8 • Practice

HP6A - Systematic enumeration • Questions 1-2

Q01 | 4 MARKS

A code uses one of 6 letters followed by one of 4 digits. Exactly 4 specified letter-digit pairs are forbidden. Use the product rule to find the number of valid codes, then explain how a systematic list would verify that no outcome was counted twice. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A code uses one of 5 letters followed by one of 5 digits. Exactly 4 specified letter-digit pairs are forbidden. Use the product rule to find the number of valid codes, then explain how a systematic list would verify that no outcome was counted twice. Your solution must justify the main method or assumption and include a final check.

Chapter 8 • Practice

HP6A - Systematic enumeration • Questions 3-4

Q03 | 4 MARKS

A code uses one of 4 letters followed by one of 6 digits. Exactly 2 specified letter-digit pairs are forbidden. Use the product rule to find the number of valid codes, then explain how a systematic list would verify that no outcome was counted twice. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A code uses one of 3 letters followed by one of 7 digits. Exactly 1 specified letter-digit pairs are forbidden. Use the product rule to find the number of valid codes, then explain how a systematic list would verify that no outcome was counted twice. Your solution must justify the main method or assumption and include a final check.

Chapter 8 • Practice

HP6A - Systematic enumeration • Questions 5-6

Q05 | 4 MARKS

A code uses one of 6 letters followed by one of 8 digits. Exactly 4 specified letter-digit pairs are forbidden. Use the product rule to find the number of valid codes, then explain how a systematic list would verify that no outcome was counted twice. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A code uses one of 5 letters followed by one of 4 digits. Exactly 3 specified letter-digit pairs are forbidden. Use the product rule to find the number of valid codes, then explain how a systematic list would verify that no outcome was counted twice. Your solution must justify the main method or assumption and include a final check.

Chapter 8 • Practice

HP6A - Systematic enumeration • Questions 7-8

Q07 | 4 MARKS

A code uses one of 4 letters followed by one of 5 digits. Exactly 2 specified letter-digit pairs are forbidden. Use the product rule to find the number of valid codes, then explain how a systematic list would verify that no outcome was counted twice. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A code uses one of 3 letters followed by one of 6 digits. Exactly 1 specified letter-digit pairs are forbidden. Use the product rule to find the number of valid codes, then explain how a systematic list would verify that no outcome was counted twice. Your solution must justify the main method or assumption and include a final check.

Chapter 8 • Practice

HP6A - Systematic enumeration • Questions 9-10

Q09 | 4 MARKS

A code uses one of 6 letters followed by one of 7 digits. Exactly 4 specified letter-digit pairs are forbidden. Use the product rule to find the number of valid codes, then explain how a systematic list would verify that no outcome was counted twice. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

A code uses one of 5 letters followed by one of 8 digits. Exactly 3 specified letter-digit pairs are forbidden. Use the product rule to find the number of valid codes, then explain how a systematic list would verify that no outcome was counted twice. Your solution must justify the main method or assumption and include a final check.

Chapter 8 • Practice

HP6A - Systematic enumeration • Questions 11-12

Q11 | 5 MARKS

You must show your working. A code uses one of 6 letters followed by one of 5 digits. Exactly 4 specified letter-digit pairs are forbidden. Use the product rule to find the number of valid codes, then explain how a systematic list would verify that no outcome was counted twice. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A code uses one of 3 letters followed by one of 7 digits. Exactly 3 specified letter-digit pairs are forbidden. Use the product rule to find the number of valid codes, then explain how a systematic list would verify that no outcome was counted twice. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 8

HP6A - Systematic enumeration • Questions 1-2

Q01 | 4 MARKS

Before restrictions there are $6 \times 4 = 24$ ordered codes. Removing 4 distinct forbidden pairs leaves 20. A verification list groups codes by first letter and lists every allowed digit once within each group, preventing omission or duplication. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

Before restrictions there are $5 \times 5 = 25$ ordered codes. Removing 4 distinct forbidden pairs leaves 21. A verification list groups codes by first letter and lists every allowed digit once within each group, preventing omission or duplication. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 8

HP6A - Systematic enumeration • Questions 3-4

Q03 | 4 MARKS

Before restrictions there are $4 \times 6 = 24$ ordered codes. Removing 2 distinct forbidden pairs leaves 22. A verification list groups codes by first letter and lists every allowed digit once within each group, preventing omission or duplication. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

Before restrictions there are $3 \times 7 = 21$ ordered codes. Removing 1 distinct forbidden pairs leaves 20. A verification list groups codes by first letter and lists every allowed digit once within each group, preventing omission or duplication. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 8

HP6A - Systematic enumeration • Questions 5–6

Q05 | 4 MARKS

Before restrictions there are $6 \times 8 = 48$ ordered codes. Removing 4 distinct forbidden pairs leaves 44. A verification list groups codes by first letter and lists every allowed digit once within each group, preventing omission or duplication. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

Before restrictions there are $5 \times 4 = 20$ ordered codes. Removing 3 distinct forbidden pairs leaves 17. A verification list groups codes by first letter and lists every allowed digit once within each group, preventing omission or duplication. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 8

HP6A - Systematic enumeration • Questions 7-8

Q07 | 4 MARKS

Before restrictions there are $4 \times 5 = 20$ ordered codes. Removing 2 distinct forbidden pairs leaves 18. A verification list groups codes by first letter and lists every allowed digit once within each group, preventing omission or duplication. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

Before restrictions there are $3 \times 6 = 18$ ordered codes. Removing 1 distinct forbidden pairs leaves 17. A verification list groups codes by first letter and lists every allowed digit once within each group, preventing omission or duplication. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 8

HP6A - Systematic enumeration • Questions 9-10

Q09 | 4 MARKS

Before restrictions there are $6 \times 7 = 42$ ordered codes. Removing 4 distinct forbidden pairs leaves 38. A verification list groups codes by first letter and lists every allowed digit once within each group, preventing omission or duplication. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

Before restrictions there are $5 \times 8 = 40$ ordered codes. Removing 3 distinct forbidden pairs leaves 37. A verification list groups codes by first letter and lists every allowed digit once within each group, preventing omission or duplication. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 8

HP6A - Systematic enumeration • Questions 11-12

Q11 | 5 MARKS

Before restrictions there are $6 \times 5 = 30$ ordered codes. Removing 4 distinct forbidden pairs leaves 26. A verification list groups codes by first letter and lists every allowed digit once within each group, preventing omission or duplication. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

Before restrictions there are $3 \times 7 = 21$ ordered codes. Removing 3 distinct forbidden pairs leaves 18. A verification list groups codes by first letter and lists every allowed digit once within each group, preventing omission or duplication. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 8 • Completion and retest record

HP6A - Systematic enumeration

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 9****HP6B - Sets and Venn diagrams****Chapter purpose**

Represent unions, intersections and complements and allocate frequencies consistently.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 9 • Method and assessment map

HP6B - Sets and Venn diagrams

Specification focus

Represent unions, intersections and complements and allocate frequencies consistently.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 9 • Practice

HP6B - Sets and Venn diagrams • Questions 1-2

Q01 | 4 MARKS

Of 195 members, 70 are in set A, 53 are in set B and 33 are in A intersection B. Fill every Venn region, then calculate $P((A \cup B)^c)$ and $P(A \cap B^c)$. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Of 210 members, 73 are in set A, 59 are in set B and 18 are in A intersection B. Fill every Venn region, then calculate $P((A \cup B)^c)$ and $P(A \cap B^c)$. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HP6B - Sets and Venn diagrams • Questions 3-4

Q03 | 4 MARKS

Of 225 members, 76 are in set A, 65 are in set B and 21 are in A intersection B. Fill every Venn region, then calculate $P((A \cup B)^c)$ and $P(A \cap B^c)$. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Of 240 members, 79 are in set A, 71 are in set B and 24 are in A intersection B. Fill every Venn region, then calculate $P((A \cup B)^c)$ and $P(A \cap B^c)$. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HP6B - Sets and Venn diagrams • Questions 5-6

Q05 | 4 MARKS

Of 255 members, 57 are in set A, 52 are in set B and 27 are in A intersection B. Fill every Venn region, then calculate $P((A \cup B)^c)$ and $P(A \cap B^c)$. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Of 270 members, 60 are in set A, 58 are in set B and 30 are in A intersection B. Fill every Venn region, then calculate $P((A \cup B)^c)$ and $P(A \cap B^c)$. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HP6B - Sets and Venn diagrams • Questions 7-8

Q07 | 4 MARKS

Of 285 members, 63 are in set A, 64 are in set B and 33 are in A intersection B. Fill every Venn region, then calculate $P((A \cup B)^c)$ and $P(A \cap B^c)$. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Of 300 members, 66 are in set A, 70 are in set B and 18 are in A intersection B. Fill every Venn region, then calculate $P((A \cup B)^c)$ and $P(A \cap B^c)$. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HP6B - Sets and Venn diagrams • Questions 9-10

Q09 | 4 MARKS

Of 315 members, 69 are in set A, 51 are in set B and 21 are in A intersection B. Fill every Venn region, then calculate $P((A \cup B)^c)$ and $P(A \cap B^c)$. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

Of 330 members, 72 are in set A, 57 are in set B and 24 are in A intersection B. Fill every Venn region, then calculate $P((A \cup B)^c)$ and $P(A \cap B^c)$. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HP6B - Sets and Venn diagrams • Questions 11-12

Q11 | 5 MARKS

You must show your working. Of 335 members, 73 are in set A, 59 are in set B and 25 are in A intersection B. Fill every Venn region, then calculate $P((A \cup B)^c)$ and $P(A \cap B^c)$. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. Of 340 members, 74 are in set A, 61 are in set B and 26 are in A intersection B. Fill every Venn region, then calculate $P((A \cup B)^c)$ and $P(A \cap B^c)$. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 9

HP6B - Sets and Venn diagrams • Questions 1-2

Q01 | 4 MARKS

A-only = $70 - 33 = 37$; B-only = $53 - 33 = 20$; neither = $195 - (70 + 53 - 33) = 105$. Thus $P((A \cup B) \text{ complement}) = 7/13$ and $P(A \cap B \text{ complement}) = 37/195$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

A-only = $73 - 18 = 55$; B-only = $59 - 18 = 41$; neither = $210 - (73 + 59 - 18) = 96$. Thus $P((A \cup B) \text{ complement}) = 16/35$ and $P(A \cap B \text{ complement}) = 11/42$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 9

HP6B - Sets and Venn diagrams • Questions 3–4

Q03 | 4 MARKS

A-only = $76 - 21 = 55$; B-only = $65 - 21 = 44$; neither = $225 - (76 + 65 - 21) = 105$. Thus $P((A \cup B) \text{ complement}) = 7/15$ and $P(A \cap B \text{ complement}) = 11/45$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

A-only = $79 - 24 = 55$; B-only = $71 - 24 = 47$; neither = $240 - (79 + 71 - 24) = 114$. Thus $P((A \cup B) \text{ complement}) = 19/40$ and $P(A \cap B \text{ complement}) = 11/48$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 9

HP6B - Sets and Venn diagrams • Questions 5–6

Q05 | 4 MARKS

A-only= $57-27=30$; B-only= $52-27=25$; neither= $255-(57+52-27)=173$. Thus $P((A \cup B) \text{ complement})=173/255$ and $P(A \cap B \text{ complement})=2/17$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

A-only= $60-30=30$; B-only= $58-30=28$; neither= $270-(60+58-30)=182$. Thus $P((A \cup B) \text{ complement})=91/135$ and $P(A \cap B \text{ complement})=1/9$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 9

HP6B - Sets and Venn diagrams • Questions 7-8

Q07 | 4 MARKS

A-only= $63-33=30$; B-only= $64-33=31$; neither= $285-(63+64-33)=191$. Thus $P((A \cup B) \text{ complement})=191/285$ and $P(A \cap B \text{ complement})=2/19$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

A-only= $66-18=48$; B-only= $70-18=52$; neither= $300-(66+70-18)=182$. Thus $P((A \cup B) \text{ complement})=91/150$ and $P(A \cap B \text{ complement})=4/25$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 9

HP6B - Sets and Venn diagrams • Questions 9-10

Q09 | 4 MARKS

A-only= $69-21=48$; B-only= $51-21=30$; neither= $315-(69+51-21)=216$. Thus $P((A \cup B) \text{ complement})=24/35$ and $P(A \cap B \text{ complement})=16/105$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

A-only= $72-24=48$; B-only= $57-24=33$; neither= $330-(72+57-24)=225$. Thus $P((A \cup B) \text{ complement})=15/22$ and $P(A \cap B \text{ complement})=8/55$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 9

HP6B - Sets and Venn diagrams • Questions 11-12

Q11 | 5 MARKS

A-only = $73 - 25 = 48$; B-only = $59 - 25 = 34$; neither = $335 - (73 + 59 - 25) = 228$. Thus $P((A \cup B) \text{ complement}) = 228/335$ and $P(A \cap B \text{ complement}) = 48/335$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

A-only = $74 - 26 = 48$; B-only = $61 - 26 = 35$; neither = $340 - (74 + 61 - 26) = 231$. Thus $P((A \cup B) \text{ complement}) = 231/340$ and $P(A \cap B \text{ complement}) = 12/85$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 9 • Completion and retest record

HP6B - Sets and Venn diagrams

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 10****HP7 - Theoretical possibility spaces****Chapter purpose**

Construct grids and spaces for combined experiments and calculate event probabilities.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 10 • Method and assessment map

HP7 - Theoretical possibility spaces

Specification focus

Construct grids and spaces for combined experiments and calculate event probabilities.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 10 • Practice

HP7 - Theoretical possibility spaces • Questions 1-2

Q01 | 4 MARKS

Two fair 4-sided spinners numbered 1 to 4 are spun. Construct a possibility-space argument to find $P(\text{total at least } 6)$. Then find $P(\text{the two scores are equal or the total is at least } 6)$. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Two fair 7-sided spinners numbered 1 to 7 are spun. Construct a possibility-space argument to find $P(\text{total at least } 10)$. Then find $P(\text{the two scores are equal or the total is at least } 10)$. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HP7 - Theoretical possibility spaces • Questions 3-4

Q03 | 4 MARKS

Two fair 5-sided spinners numbered 1 to 5 are spun. Construct a possibility-space argument to find $P(\text{total at least } 8)$. Then find $P(\text{the two scores are equal or the total is at least } 8)$. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Two fair 8-sided spinners numbered 1 to 8 are spun. Construct a possibility-space argument to find $P(\text{total at least } 14)$. Then find $P(\text{the two scores are equal or the total is at least } 14)$. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HP7 - Theoretical possibility spaces • Questions 5-6

Q05 | 4 MARKS

Two fair 6-sided spinners numbered 1 to 6 are spun. Construct a possibility-space argument to find $P(\text{total at least } 10)$. Then find $P(\text{the two scores are equal or the total is at least } 10)$. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Two fair 4-sided spinners numbered 1 to 4 are spun. Construct a possibility-space argument to find $P(\text{total at least } 7)$. Then find $P(\text{the two scores are equal or the total is at least } 7)$. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HP7 - Theoretical possibility spaces • Questions 7-8

Q07 | 4 MARKS

Two fair 7-sided spinners numbered 1 to 7 are spun. Construct a possibility-space argument to find $P(\text{total at least } 12)$. Then find $P(\text{the two scores are equal or the total is at least } 12)$. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Two fair 5-sided spinners numbered 1 to 5 are spun. Construct a possibility-space argument to find $P(\text{total at least } 5)$. Then find $P(\text{the two scores are equal or the total is at least } 5)$. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HP7 - Theoretical possibility spaces • Questions 9-10

Q09 | 4 MARKS

Two fair 8-sided spinners numbered 1 to 8 are spun. Construct a possibility-space argument to find $P(\text{total at least } 14)$. Then find $P(\text{the two scores are equal or the total is at least } 14)$. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Q10 | 4 MARKS

Two fair 6-sided spinners numbered 1 to 6 are spun. Construct a possibility-space argument to find $P(\text{total at least } 14)$. Then find $P(\text{the two scores are equal or the total is at least } 14)$. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HP7 - Theoretical possibility spaces • Questions 11-12

Q11 | 5 MARKS

You must show your working. Two fair 7-sided spinners numbered 1 to 7 are spun. Construct a possibility-space argument to find $P(\text{total at least } 9)$. Then find $P(\text{the two scores are equal or the total is at least } 9)$. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. Two fair 8-sided spinners numbered 1 to 8 are spun. Construct a possibility-space argument to find $P(\text{total at least } 19)$. Then find $P(\text{the two scores are equal or the total is at least } 19)$. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 10

HP7 - Theoretical possibility spaces • Questions 1-2

Q01 | 4 MARKS

There are 16 equally likely ordered outcomes. The region with total at least 6 contains 6, so probability= $\frac{3}{8}$. Equality contains 4 outcomes, with 2 also in the high-total region. Union count= $6+4-2=8$, giving $\frac{1}{2}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

There are 49 equally likely ordered outcomes. The region with total at least 10 contains 15, so probability= $\frac{15}{49}$. Equality contains 7 outcomes, with 3 also in the high-total region. Union count= $15+7-3=19$, giving $\frac{19}{49}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 10

HP7 - Theoretical possibility spaces • Questions 3-4

Q03 | 4 MARKS

There are 25 equally likely ordered outcomes. The region with total at least 8 contains 6, so probability= $6/25$. Equality contains 5 outcomes, with 2 also in the high-total region. Union count= $6+5-2=9$, giving $9/25$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

There are 64 equally likely ordered outcomes. The region with total at least 14 contains 6, so probability= $3/32$. Equality contains 8 outcomes, with 2 also in the high-total region. Union count= $6+8-2=12$, giving $3/16$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 10

HP7 - Theoretical possibility spaces • Questions 5-6

Q05 | 4 MARKS

There are 36 equally likely ordered outcomes. The region with total at least 10 contains 6, so probability = $\frac{1}{6}$. Equality contains 6 outcomes, with 2 also in the high-total region. Union count = $6 + 6 - 2 = 10$, giving $\frac{5}{18}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

There are 16 equally likely ordered outcomes. The region with total at least 7 contains 3, so probability = $\frac{3}{16}$. Equality contains 4 outcomes, with 1 also in the high-total region. Union count = $3 + 4 - 1 = 6$, giving $\frac{3}{8}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 10

HP7 - Theoretical possibility spaces • Questions 7-8

Q07 | 4 MARKS

There are 49 equally likely ordered outcomes. The region with total at least 12 contains 6, so probability= $6/49$. Equality contains 7 outcomes, with 2 also in the high-total region. Union count= $6+7-2=11$, giving $11/49$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

There are 25 equally likely ordered outcomes. The region with total at least 5 contains 19, so probability= $19/25$. Equality contains 5 outcomes, with 3 also in the high-total region. Union count= $19+5-3=21$, giving $21/25$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 10

HP7 - Theoretical possibility spaces • Questions 9-10

Q09 | 4 MARKS

There are 64 equally likely ordered outcomes. The region with total at least 14 contains 6, so probability = $\frac{3}{32}$. Equality contains 8 outcomes, with 2 also in the high-total region. Union count = $6 + 8 - 2 = 12$, giving $\frac{3}{16}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

There are 36 equally likely ordered outcomes. The region with total at least 14 contains 0, so probability = 0. Equality contains 6 outcomes, with 0 also in the high-total region. Union count = $0 + 6 - 0 = 6$, giving $\frac{1}{6}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 10

HP7 - Theoretical possibility spaces • Questions 11-12

Q11 | 5 MARKS

There are 49 equally likely ordered outcomes. The region with total at least 9 contains 21, so probability = $\frac{3}{7}$. Equality contains 7 outcomes, with 3 also in the high-total region. Union count = $21 + 7 - 3 = 25$, giving $\frac{25}{49}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

There are 64 equally likely ordered outcomes. The region with total at least 19 contains 0, so probability = 0. Equality contains 8 outcomes, with 0 also in the high-total region. Union count = $0 + 8 - 0 = 8$, giving $\frac{1}{8}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 10 • Completion and retest record

HP7 - Theoretical possibility spaces

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 11****HP8A - Independence and the multiplication rule****Chapter purpose**

Test independence and calculate probabilities for combined independent events.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 11 • Method and assessment map

HP8A - Independence and the multiplication rule

Specification focus

Test independence and calculate probabilities for combined independent events.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 11 • Practice

HP8A - Independence and the multiplication rule • Questions 1-2

Q01 | 4 MARKS

Events A and B are independent with $P(A)=1/2$ and $P(B)=3/10$. Find $P(A \text{ and } B)$, $P(\text{exactly one of } A \text{ and } B)$, and verify independence using a conditional probability statement. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Events A and B are independent with $P(A)=1/5$ and $P(B)=2/5$. Find $P(A \text{ and } B)$, $P(\text{exactly one of } A \text{ and } B)$, and verify independence using a conditional probability statement. Your solution must justify the main method or assumption and include a final check.

Chapter 11 • Practice

HP8A - Independence and the multiplication rule • Questions 3-4

Q03 | 4 MARKS

Events A and B are independent with $P(A)=1/2$ and $P(B)=1/2$. Find $P(A \text{ and } B)$, $P(\text{exactly one of } A \text{ and } B)$, and verify independence using a conditional probability statement. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Events A and B are independent with $P(A)=1/5$ and $P(B)=3/5$. Find $P(A \text{ and } B)$, $P(\text{exactly one of } A \text{ and } B)$, and verify independence using a conditional probability statement. Your solution must justify the main method or assumption and include a final check.

Chapter 11 • Practice

HP8A - Independence and the multiplication rule • Questions 5-6

Q05 | 4 MARKS

Events A and B are independent with $P(A)=1/2$ and $P(B)=7/10$. Find $P(A \text{ and } B)$, $P(\text{exactly one of } A \text{ and } B)$, and verify independence using a conditional probability statement. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Events A and B are independent with $P(A)=1/5$ and $P(B)=3/10$. Find $P(A \text{ and } B)$, $P(\text{exactly one of } A \text{ and } B)$, and verify independence using a conditional probability statement. Your solution must justify the main method or assumption and include a final check.

Chapter 11 • Practice

HP8A - Independence and the multiplication rule • Questions 7-8

Q07 | 4 MARKS

Events A and B are independent with $P(A)=1/2$ and $P(B)=2/5$. Find $P(A \text{ and } B)$, $P(\text{exactly one of } A \text{ and } B)$, and verify independence using a conditional probability statement. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Events A and B are independent with $P(A)=1/5$ and $P(B)=1/2$. Find $P(A \text{ and } B)$, $P(\text{exactly one of } A \text{ and } B)$, and verify independence using a conditional probability statement. Your solution must justify the main method or assumption and include a final check.

Chapter 11 • Practice

HP8A - Independence and the multiplication rule • Questions 9-10

Q09 | 4 MARKS

Events A and B are independent with $P(A)=1/2$ and $P(B)=3/5$. Find $P(A \text{ and } B)$, $P(\text{exactly one of } A \text{ and } B)$, and verify independence using a conditional probability statement. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

Events A and B are independent with $P(A)=1/5$ and $P(B)=7/10$. Find $P(A \text{ and } B)$, $P(\text{exactly one of } A \text{ and } B)$, and verify independence using a conditional probability statement. Your solution must justify the main method or assumption and include a final check.

Chapter 11 • Practice

HP8A - Independence and the multiplication rule • Questions 11-12

Q11 | 5 MARKS

You must show your working. Events A and B are independent with $P(A)=3/10$ and $P(B)=2/5$. Find $P(A \text{ and } B)$, $P(\text{exactly one of } A \text{ and } B)$, and verify independence using a conditional probability statement. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. Events A and B are independent with $P(A)=2/5$ and $P(B)=3/5$. Find $P(A \text{ and } B)$, $P(\text{exactly one of } A \text{ and } B)$, and verify independence using a conditional probability statement. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 11

HP8A - Independence and the multiplication rule • Questions 1-2

Q01 | 4 MARKS

Independence gives $P(A \text{ and } B) = 1/2 \times 3/10 = 3/20$. Exactly one has two disjoint routes: $1/2 \times 7/10 + 1/2 \times 3/10 = 1/2$. Also $P(A \text{ given } B) = P(A) = 1/2$, which verifies the independence condition. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

Independence gives $P(A \text{ and } B) = 1/5 \times 2/5 = 2/25$. Exactly one has two disjoint routes: $1/5 \times 3/5 + 4/5 \times 2/5 = 11/25$. Also $P(A \text{ given } B) = P(A) = 1/5$, which verifies the independence condition. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 11

HP8A - Independence and the multiplication rule • Questions 3-4

Q03 | 4 MARKS

Independence gives $P(A \text{ and } B) = 1/2 \times 1/2 = 1/4$. Exactly one has two disjoint routes: $1/2 \times 1/2 + 1/2 \times 1/2 = 1/2$. Also $P(A \text{ given } B) = P(A) = 1/2$, which verifies the independence condition. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

Independence gives $P(A \text{ and } B) = 1/5 \times 3/5 = 3/25$. Exactly one has two disjoint routes: $1/5 \times 2/5 + 4/5 \times 3/5 = 14/25$. Also $P(A \text{ given } B) = P(A) = 1/5$, which verifies the independence condition. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 11

HP8A - Independence and the multiplication rule • Questions 5-6

Q05 | 4 MARKS

Independence gives $P(A \text{ and } B) = 1/2 \times 7/10 = 7/20$. Exactly one has two disjoint routes: $1/2 \times 3/10 + 1/2 \times 7/10 = 1/2$. Also $P(A \text{ given } B) = P(A) = 1/2$, which verifies the independence condition. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

Independence gives $P(A \text{ and } B) = 1/5 \times 3/10 = 3/50$. Exactly one has two disjoint routes: $1/5 \times 7/10 + 4/5 \times 3/10 = 19/50$. Also $P(A \text{ given } B) = P(A) = 1/5$, which verifies the independence condition. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 11

HP8A - Independence and the multiplication rule • Questions 7-8

Q07 | 4 MARKS

Independence gives $P(A \text{ and } B) = 1/2 \times 2/5 = 1/5$. Exactly one has two disjoint routes: $1/2 \times 3/5 + 1/2 \times 2/5 = 1/2$. Also $P(A \text{ given } B) = P(A) = 1/2$, which verifies the independence condition. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

Independence gives $P(A \text{ and } B) = 1/5 \times 1/2 = 1/10$. Exactly one has two disjoint routes: $1/5 \times 1/2 + 4/5 \times 1/2 = 1/2$. Also $P(A \text{ given } B) = P(A) = 1/5$, which verifies the independence condition. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 11

HP8A - Independence and the multiplication rule • Questions 9-10

Q09 | 4 MARKS

Independence gives $P(A \text{ and } B) = 1/2 \times 3/5 = 3/10$. Exactly one has two disjoint routes: $1/2 \times 2/5 + 1/2 \times 3/5 = 1/2$. Also $P(A \text{ given } B) = P(A) = 1/2$, which verifies the independence condition. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

Independence gives $P(A \text{ and } B) = 1/5 \times 7/10 = 7/50$. Exactly one has two disjoint routes: $1/5 \times 3/10 + 4/5 \times 7/10 = 31/50$. Also $P(A \text{ given } B) = P(A) = 1/5$, which verifies the independence condition. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 11

HP8A - Independence and the multiplication rule • Questions 11-12

Q11 | 5 MARKS

Independence gives $P(A \text{ and } B) = 3/10 \times 2/5 = 3/25$. Exactly one has two disjoint routes: $3/10 \times 3/5 + 7/10 \times 2/5 = 23/50$. Also $P(A \text{ given } B) = P(A) = 3/10$, which verifies the independence condition. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

Independence gives $P(A \text{ and } B) = 2/5 \times 3/5 = 6/25$. Exactly one has two disjoint routes: $2/5 \times 2/5 + 3/5 \times 3/5 = 13/25$. Also $P(A \text{ given } B) = P(A) = 2/5$, which verifies the independence condition. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 11 • Completion and retest record

HP8A - Independence and the multiplication rule

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 12****HP8B - Trees with replacement****Chapter purpose**

Construct probability trees with constant branch probabilities and combine paths correctly.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 12 • Method and assessment map

HP8B - Trees with replacement

Specification focus

Construct probability trees with constant branch probabilities and combine paths correctly.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 12 • Practice

HP8B - Trees with replacement • Questions 1-2

Q01 | 4 MARKS

A biased coin has $P(\text{head}) = \frac{1}{2}$ and is tossed three times independently. Use a tree-path argument to find $P(\text{exactly two heads})$ and $P(\text{at least one head})$. Explain why the branch probabilities stay unchanged. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A biased coin has $P(\text{head}) = \frac{1}{5}$ and is tossed three times independently. Use a tree-path argument to find $P(\text{exactly two heads})$ and $P(\text{at least one head})$. Explain why the branch probabilities stay unchanged. Your solution must justify the main method or assumption and include a final check.

Chapter 12 • Practice

HP8B - Trees with replacement • Questions 3-4

Q03 | 4 MARKS

A biased coin has $P(\text{head}) = 1/2$ and is tossed three times independently. Use a tree-path argument to find $P(\text{exactly two heads})$ and $P(\text{at least one head})$. Explain why the branch probabilities stay unchanged. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Q04 | 4 MARKS

A biased coin has $P(\text{head}) = 1/5$ and is tossed three times independently. Use a tree-path argument to find $P(\text{exactly two heads})$ and $P(\text{at least one head})$. Explain why the branch probabilities stay unchanged. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Chapter 12 • Practice

HP8B - Trees with replacement • Questions 5-6

Q05 | 4 MARKS

A biased coin has $P(\text{head}) = 1/2$ and is tossed three times independently. Use a tree-path argument to find $P(\text{exactly two heads})$ and $P(\text{at least one head})$. Explain why the branch probabilities stay unchanged. Your solution must justify the main method or assumption and include a final check. Identify the key condition you used and explain why it applies here.

Q06 | 4 MARKS

A biased coin has $P(\text{head}) = 1/5$ and is tossed three times independently. Use a tree-path argument to find $P(\text{exactly two heads})$ and $P(\text{at least one head})$. Explain why the branch probabilities stay unchanged. Your solution must justify the main method or assumption and include a final check. Identify the key condition you used and explain why it applies here.

Chapter 12 • Practice

HP8B - Trees with replacement • Questions 7-8

Q07 | 4 MARKS

A biased coin has $P(\text{head}) = 1/2$ and is tossed three times independently. Use a tree-path argument to find $P(\text{exactly two heads})$ and $P(\text{at least one head})$. Explain why the branch probabilities stay unchanged. Your solution must justify the main method or assumption and include a final check. Write one sentence interpreting your answer in the context of the question.

Q08 | 4 MARKS

A biased coin has $P(\text{head}) = 1/5$ and is tossed three times independently. Use a tree-path argument to find $P(\text{exactly two heads})$ and $P(\text{at least one head})$. Explain why the branch probabilities stay unchanged. Your solution must justify the main method or assumption and include a final check. Write one sentence interpreting your answer in the context of the question.

Chapter 12 • Practice

HP8B - Trees with replacement • Questions 9-10

Q09 | 4 MARKS

A biased coin has $P(\text{head}) = 1/2$ and is tossed three times independently. Use a tree-path argument to find $P(\text{exactly two heads})$ and $P(\text{at least one head})$. Explain why the branch probabilities stay unchanged. Your solution must justify the main method or assumption and include a final check. Describe one common error in this calculation and how your working avoids it.

Q10 | 4 MARKS

A biased coin has $P(\text{head}) = 1/5$ and is tossed three times independently. Use a tree-path argument to find $P(\text{exactly two heads})$ and $P(\text{at least one head})$. Explain why the branch probabilities stay unchanged. Your solution must justify the main method or assumption and include a final check. Describe one common error in this calculation and how your working avoids it.

Chapter 12 • Practice

HP8B - Trees with replacement • Questions 11-12

Q11 | 5 MARKS

You must show your working. A biased coin has $P(\text{head}) = \frac{3}{10}$ and is tossed three times independently. Use a tree-path argument to find $P(\text{exactly two heads})$ and $P(\text{at least one head})$. Explain why the branch probabilities stay unchanged. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A biased coin has $P(\text{head}) = \frac{2}{5}$ and is tossed three times independently. Use a tree-path argument to find $P(\text{exactly two heads})$ and $P(\text{at least one head})$. Explain why the branch probabilities stay unchanged. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 12

HP8B - Trees with replacement • Questions 1-2

Q01 | 4 MARKS

There are $C(3,2)=3$ paths with two heads, each probability $(1/2)^2(1/2)$. Hence $P(\text{exactly two})=3/8$. $P(\text{at least one})=1-P(\text{no heads})=1-(1/2)^3=7/8$. Replacement/independent trials keep each branch probability constant. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

There are $C(3,2)=3$ paths with two heads, each probability $(1/5)^2(4/5)$. Hence $P(\text{exactly two})=12/125$. $P(\text{at least one})=1-P(\text{no heads})=1-(4/5)^3=61/125$. Replacement/independent trials keep each branch probability constant. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 12

HP8B - Trees with replacement • Questions 3-4

Q03 | 4 MARKS

There are $C(3,2)=3$ paths with two heads, each probability $(1/2)^2(1/2)$. Hence $P(\text{exactly two})=3/8$. $P(\text{at least one})=1-P(\text{no heads})=1-(1/2)^3=7/8$. Replacement/independent trials keep each branch probability constant. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

There are $C(3,2)=3$ paths with two heads, each probability $(1/5)^2(4/5)$. Hence $P(\text{exactly two})=12/125$. $P(\text{at least one})=1-P(\text{no heads})=1-(4/5)^3=61/125$. Replacement/independent trials keep each branch probability constant. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 12

HP8B - Trees with replacement • Questions 5-6

Q05 | 4 MARKS

There are $C(3,2)=3$ paths with two heads, each probability $(1/2)^2(1/2)$. Hence $P(\text{exactly two})=3/8$. $P(\text{at least one})=1-P(\text{no heads})=1-(1/2)^3=7/8$. Replacement/independent trials keep each branch probability constant. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The explanation must name the relevant condition and link it explicitly to the method used.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

There are $C(3,2)=3$ paths with two heads, each probability $(1/5)^2(4/5)$. Hence $P(\text{exactly two})=12/125$. $P(\text{at least one})=1-P(\text{no heads})=1-(4/5)^3=61/125$. Replacement/independent trials keep each branch probability constant. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The explanation must name the relevant condition and link it explicitly to the method used.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 12

HP8B - Trees with replacement • Questions 7-8

Q07 | 4 MARKS

There are $C(3,2)=3$ paths with two heads, each probability $(1/2)^2(1/2)$. Hence $P(\text{exactly two})=3/8$. $P(\text{at least one})=1-P(\text{no heads})=1-(1/2)^3=7/8$. Replacement/independent trials keep each branch probability constant. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The interpretation should include the correct units or geometric/statistical meaning where applicable.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

There are $C(3,2)=3$ paths with two heads, each probability $(1/5)^2(4/5)$. Hence $P(\text{exactly two})=12/125$. $P(\text{at least one})=1-P(\text{no heads})=1-(4/5)^3=61/125$. Replacement/independent trials keep each branch probability constant. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The interpretation should include the correct units or geometric/statistical meaning where applicable.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 12

HP8B - Trees with replacement • Questions 9-10

Q09 | 4 MARKS

There are $C(3,2)=3$ paths with two heads, each probability $(1/2)^2(1/2)$. Hence $P(\text{exactly two})=3/8$. $P(\text{at least one})=1-P(\text{no heads})=1-(1/2)^3=7/8$. Replacement/independent trials keep each branch probability constant. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid response identifies a plausible error and points to the step that prevents it.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

There are $C(3,2)=3$ paths with two heads, each probability $(1/5)^2(4/5)$. Hence $P(\text{exactly two})=12/125$. $P(\text{at least one})=1-P(\text{no heads})=1-(4/5)^3=61/125$. Replacement/independent trials keep each branch probability constant. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid response identifies a plausible error and points to the step that prevents it.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 12

HP8B - Trees with replacement • Questions 11-12

Q11 | 5 MARKS

There are $C(3,2)=3$ paths with two heads, each probability $(\frac{3}{10})^2(\frac{7}{10})$. Hence $P(\text{exactly two})=\frac{189}{1000}$. $P(\text{at least one})=1-P(\text{no heads})=1-(\frac{7}{10})^3=\frac{657}{1000}$. Replacement/independent trials keep each branch probability constant. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

There are $C(3,2)=3$ paths with two heads, each probability $(\frac{2}{5})^2(\frac{3}{5})$. Hence $P(\text{exactly two})=\frac{36}{125}$. $P(\text{at least one})=1-P(\text{no heads})=1-(\frac{3}{5})^3=\frac{98}{125}$. Replacement/independent trials keep each branch probability constant. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 12 • Completion and retest record

HP8B - Trees with replacement

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 13****HP8C - Dependent trees without replacement****Chapter purpose**

Update numerators and denominators and state the dependence assumption.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.

Questions 9–12 provide the chapter stretch sequence.

Chapter 13 • Method and assessment map

HP8C - Dependent trees without replacement

Specification focus

Update numerators and denominators and state the dependence assumption.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 13 • Practice

HP8C - Dependent trees without replacement • Questions 1-2

Q01 | 4 MARKS

A bag contains 7 red and 7 blue counters. Two are selected without replacement. Find $P(\text{two red})$ and $P(\text{one of each colour})$. Show the changing denominators and combine all valid orders. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A bag contains 4 red and 6 blue counters. Two are selected without replacement. Find $P(\text{two red})$ and $P(\text{one of each colour})$. Show the changing denominators and combine all valid orders. Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HP8C - Dependent trees without replacement • Questions 3-4

Q03 | 4 MARKS

A bag contains 7 red and 5 blue counters. Two are selected without replacement. Find $P(\text{two red})$ and $P(\text{one of each colour})$. Show the changing denominators and combine all valid orders. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A bag contains 4 red and 11 blue counters. Two are selected without replacement. Find $P(\text{two red})$ and $P(\text{one of each colour})$. Show the changing denominators and combine all valid orders. Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HP8C - Dependent trees without replacement • Questions 5-6

Q05 | 4 MARKS

A bag contains 7 red and 10 blue counters. Two are selected without replacement. Find $P(\text{two red})$ and $P(\text{one of each colour})$. Show the changing denominators and combine all valid orders. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A bag contains 4 red and 9 blue counters. Two are selected without replacement. Find $P(\text{two red})$ and $P(\text{one of each colour})$. Show the changing denominators and combine all valid orders. Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HP8C - Dependent trees without replacement • Questions 7-8

Q07 | 4 MARKS

A bag contains 7 red and 8 blue counters. Two are selected without replacement. Find $P(\text{two red})$ and $P(\text{one of each colour})$. Show the changing denominators and combine all valid orders. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A bag contains 4 red and 7 blue counters. Two are selected without replacement. Find $P(\text{two red})$ and $P(\text{one of each colour})$. Show the changing denominators and combine all valid orders. Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HP8C - Dependent trees without replacement • Questions 9-10

Q09 | 4 MARKS

A bag contains 7 red and 6 blue counters. Two are selected without replacement. Find $P(\text{two red})$ and $P(\text{one of each colour})$. Show the changing denominators and combine all valid orders. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

A bag contains 4 red and 5 blue counters. Two are selected without replacement. Find $P(\text{two red})$ and $P(\text{one of each colour})$. Show the changing denominators and combine all valid orders. Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HP8C - Dependent trees without replacement • Questions 11-12

Q11 | 5 MARKS

You must show your working. A bag contains 5 red and 7 blue counters. Two are selected without replacement. Find $P(\text{two red})$ and $P(\text{one of each colour})$. Show the changing denominators and combine all valid orders. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A bag contains 6 red and 9 blue counters. Two are selected without replacement. Find $P(\text{two red})$ and $P(\text{one of each colour})$. Show the changing denominators and combine all valid orders. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 13

HP8C - Dependent trees without replacement • Questions 1-2

Q01 | 4 MARKS

$P(RR) = \frac{7}{14} \times \frac{6}{13} = \frac{3}{13}$. One of each can be RB or BR: $\frac{7}{14} \times \frac{7}{13} + \frac{7}{14} \times \frac{7}{13} = \frac{7}{13}$. The second denominator is 13 because the first counter is not replaced. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

$P(RR) = \frac{4}{10} \times \frac{3}{9} = \frac{2}{15}$. One of each can be RB or BR: $\frac{4}{10} \times \frac{6}{9} + \frac{6}{10} \times \frac{4}{9} = \frac{8}{15}$. The second denominator is 9 because the first counter is not replaced. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 13

HP8C - Dependent trees without replacement • Questions 3-4

Q03 | 4 MARKS

$P(RR) = \frac{7}{12} \times \frac{6}{11} = \frac{7}{22}$. One of each can be RB or BR: $\frac{7}{12} \times \frac{5}{11} + \frac{5}{12} \times \frac{7}{11} = \frac{35}{66}$. The second denominator is 11 because the first counter is not replaced. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

$P(RR) = \frac{4}{15} \times \frac{3}{14} = \frac{2}{35}$. One of each can be RB or BR: $\frac{4}{15} \times \frac{11}{14} + \frac{11}{15} \times \frac{4}{14} = \frac{44}{105}$. The second denominator is 14 because the first counter is not replaced. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 13

HP8C - Dependent trees without replacement • Questions 5-6

Q05 | 4 MARKS

$P(RR) = 7/17 \times 6/16 = 21/136$. One of each can be RB or BR: $7/17 \times 10/16 + 10/17 \times 7/16 = 35/68$. The second denominator is 16 because the first counter is not replaced. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

$P(RR) = 4/13 \times 3/12 = 1/13$. One of each can be RB or BR: $4/13 \times 9/12 + 9/13 \times 4/12 = 6/13$. The second denominator is 12 because the first counter is not replaced. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 13

HP8C - Dependent trees without replacement • Questions 7-8

Q07 | 4 MARKS

$P(RR) = 7/15 \times 6/14 = 1/5$. One of each can be RB or BR: $7/15 \times 8/14 + 8/15 \times 7/14 = 8/15$. The second denominator is 14 because the first counter is not replaced. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

$P(RR) = 4/11 \times 3/10 = 6/55$. One of each can be RB or BR: $4/11 \times 7/10 + 7/11 \times 4/10 = 28/55$. The second denominator is 10 because the first counter is not replaced. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 13

HP8C - Dependent trees without replacement • Questions 9-10

Q09 | 4 MARKS

$P(RR) = \frac{7}{13} \times \frac{6}{12} = \frac{7}{26}$. One of each can be RB or BR: $\frac{7}{13} \times \frac{6}{12} + \frac{6}{13} \times \frac{7}{12} = \frac{7}{13}$. The second denominator is 12 because the first counter is not replaced. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

$P(RR) = \frac{4}{9} \times \frac{3}{8} = \frac{1}{6}$. One of each can be RB or BR: $\frac{4}{9} \times \frac{5}{8} + \frac{5}{9} \times \frac{4}{8} = \frac{5}{9}$. The second denominator is 8 because the first counter is not replaced. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 13

HP8C - Dependent trees without replacement • Questions 11-12

Q11 | 5 MARKS

$P(RR) = \frac{5}{12} \times \frac{4}{11} = \frac{5}{33}$. One of each can be RB or BR: $\frac{5}{12} \times \frac{7}{11} + \frac{7}{12} \times \frac{5}{11} = \frac{35}{66}$. The second denominator is 11 because the first counter is not replaced. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

$P(RR) = \frac{6}{15} \times \frac{5}{14} = \frac{1}{7}$. One of each can be RB or BR: $\frac{6}{15} \times \frac{9}{14} + \frac{9}{15} \times \frac{6}{14} = \frac{18}{35}$. The second denominator is 14 because the first counter is not replaced. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 13 • Completion and retest record

HP8C - Dependent trees without replacement

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 14****HP8D - Repeated-event probability****Chapter purpose**

Calculate exactly, at-least and complementary probabilities over repeated independent trials.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 14 • Method and assessment map

HP8D - Repeated-event probability

Specification focus

Calculate exactly, at-least and complementary probabilities over repeated independent trials.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 14 • Practice

HP8D - Repeated-event probability • Questions 1-2

Q01 | 4 MARKS

An event has probability $\frac{1}{2}$ on each of 5 independent trials. Find the probability of exactly 3 occurrences and of at least one occurrence. Explain the combinatorial multiplier in the exact calculation.

Q02 | 4 MARKS

An event has probability $\frac{1}{5}$ on each of 4 independent trials. Find the probability of exactly 2 occurrences and of at least one occurrence. Explain the combinatorial multiplier in the exact calculation.

Chapter 14 • Practice

HP8D - Repeated-event probability • Questions 3-4

Q03 | 5 MARKS

An event has probability $\frac{1}{2}$ on each of 5 independent trials. Find the probability of exactly 3 occurrences and of at least one occurrence. Explain the combinatorial multiplier in the exact calculation. Verify the result using an independent inverse operation or a second representation.

Q04 | 5 MARKS

An event has probability $\frac{1}{5}$ on each of 4 independent trials. Find the probability of exactly 2 occurrences and of at least one occurrence. Explain the combinatorial multiplier in the exact calculation. Verify the result using an independent inverse operation or a second representation.

Chapter 14 • Practice

HP8D - Repeated-event probability • Questions 5-6

Q05 | 5 MARKS

An event has probability $\frac{1}{2}$ on each of 5 independent trials. Find the probability of exactly 3 occurrences and of at least one occurrence. Explain the combinatorial multiplier in the exact calculation. Identify one plausible incorrect approach and explain precisely why it fails.

Q06 | 5 MARKS

An event has probability $\frac{1}{5}$ on each of 4 independent trials. Find the probability of exactly 2 occurrences and of at least one occurrence. Explain the combinatorial multiplier in the exact calculation. Identify one plausible incorrect approach and explain precisely why it fails.

Chapter 14 • Practice

HP8D - Repeated-event probability • Questions 7-8

Q07 | 5 MARKS

An event has probability $\frac{1}{2}$ on each of 5 independent trials. Find the probability of exactly 3 occurrences and of at least one occurrence. Explain the combinatorial multiplier in the exact calculation. State the key condition that makes your method valid, then test that condition.

Q08 | 5 MARKS

An event has probability $\frac{1}{5}$ on each of 4 independent trials. Find the probability of exactly 2 occurrences and of at least one occurrence. Explain the combinatorial multiplier in the exact calculation. State the key condition that makes your method valid, then test that condition.

Chapter 14 • Practice

HP8D - Repeated-event probability • Questions 9-10

Q09 | 5 MARKS

An event has probability $\frac{1}{2}$ on each of 5 independent trials. Find the probability of exactly 3 occurrences and of at least one occurrence. Explain the combinatorial multiplier in the exact calculation. Compare two valid solution methods and explain which is more efficient here.

Q10 | 5 MARKS

An event has probability $\frac{1}{5}$ on each of 4 independent trials. Find the probability of exactly 2 occurrences and of at least one occurrence. Explain the combinatorial multiplier in the exact calculation. Compare two valid solution methods and explain which is more efficient here.

Chapter 14 • Practice

HP8D - Repeated-event probability • Questions 11-12

Q11 | 5 MARKS

You must show your working. An event has probability $\frac{3}{10}$ on each of 5 independent trials. Find the probability of exactly 3 occurrences and of at least one occurrence. Explain the combinatorial multiplier in the exact calculation.

Q12 | 6 MARKS

You must show your working. An event has probability $\frac{2}{5}$ on each of 4 independent trials. Find the probability of exactly 2 occurrences and of at least one occurrence. Explain the combinatorial multiplier in the exact calculation.

Worked solutions • Chapter 14

HP8D - Repeated-event probability • Questions 1-2

Q01 | 4 MARKS

Exactly 3: choose the 3 successful positions in $C(5,3)=10$ ways. Probability $=10 \times (1/2)^3 \times (1/2)^2 = 5/16$. At least one $=1 - P(\text{none}) = 1 - (1/2)^5 = 31/32$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

Exactly 2: choose the 2 successful positions in $C(4,2)=6$ ways. Probability $=6 \times (1/5)^2 \times (4/5)^2 = 96/625$. At least one $=1 - P(\text{none}) = 1 - (4/5)^4 = 369/625$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 14

HP8D - Repeated-event probability • Questions 3-4

Q03 | 5 MARKS

Exactly 3: choose the 3 successful positions in $C(5,3)=10$ ways. Probability $=10 \times (1/2)^3 \times (1/2)^2 = 5/16$. At least one $=1-P(\text{none})=1-(1/2)^5=31/32$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate. Accept a correct independent verification using an inverse operation, substitution, alternative representation or equivalent check.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 5 MARKS

Exactly 2: choose the 2 successful positions in $C(4,2)=6$ ways. Probability $=6 \times (1/5)^2 \times (4/5)^2 = 96/625$. At least one $=1-P(\text{none})=1-(4/5)^4=369/625$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate. Accept a correct independent verification using an inverse operation, substitution, alternative representation or equivalent check.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 14

HP8D - Repeated-event probability • Questions 5-6

Q05 | 5 MARKS

Exactly 3: choose the 3 successful positions in $C(5,3)=10$ ways. Probability $=10 \times (1/2)^3 \times (1/2)^2 = 5/16$. At least one $=1-P(\text{none})=1-(1/2)^5=31/32$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The explanation must name the relevant condition and link it explicitly to the method used. Accept any mathematically specific incorrect approach with a correct explanation of the failed assumption or operation.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 5 MARKS

Exactly 2: choose the 2 successful positions in $C(4,2)=6$ ways. Probability $=6 \times (1/5)^2 \times (4/5)^2 = 96/625$. At least one $=1-P(\text{none})=1-(4/5)^4=369/625$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The explanation must name the relevant condition and link it explicitly to the method used. Accept any mathematically specific incorrect approach with a correct explanation of the failed assumption or operation.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 14

HP8D - Repeated-event probability • Questions 7-8

Q07 | 5 MARKS

Exactly 3: choose the 3 successful positions in $C(5,3)=10$ ways. Probability $=10 \times (1/2)^3 \times (1/2)^2 = 5/16$. At least one $= 1 - P(\text{none}) = 1 - (1/2)^5 = 31/32$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The interpretation should include the correct units or geometric/statistical meaning where applicable. Credit a correct validity condition and an explicit check that it holds in this case.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 5 MARKS

Exactly 2: choose the 2 successful positions in $C(4,2)=6$ ways. Probability $=6 \times (1/5)^2 \times (4/5)^2 = 96/625$. At least one $= 1 - P(\text{none}) = 1 - (4/5)^4 = 369/625$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The interpretation should include the correct units or geometric/statistical meaning where applicable. Credit a correct validity condition and an explicit check that it holds in this case.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 14

HP8D - Repeated-event probability • Questions 9-10

Q09 | 5 MARKS

Exactly 3: choose the 3 successful positions in $C(5,3)=10$ ways. Probability $=10 \times (1/2)^3 \times (1/2)^2 = 5/16$. At least one $= 1 - P(\text{none}) = 1 - (1/2)^5 = 31/32$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid response identifies a plausible error and points to the step that prevents it. Accept two valid methods and a mathematically relevant comparison of their efficiency or clarity.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 5 MARKS

Exactly 2: choose the 2 successful positions in $C(4,2)=6$ ways. Probability $=6 \times (1/5)^2 \times (4/5)^2 = 96/625$. At least one $= 1 - P(\text{none}) = 1 - (4/5)^4 = 369/625$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid response identifies a plausible error and points to the step that prevents it. Accept two valid methods and a mathematically relevant comparison of their efficiency or clarity.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 14

HP8D - Repeated-event probability • Questions 11-12

Q11 | 5 MARKS

Exactly 3: choose the 3 successful positions in $C(5,3)=10$ ways. Probability= $10 \times (3/10)^3 \times (7/10)^2 = 1323/10000$. At least one= $1-P(\text{none})=1-(7/10)^5=83193/100000$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

Exactly 2: choose the 2 successful positions in $C(4,2)=6$ ways. Probability= $6 \times (2/5)^2 \times (3/5)^2 = 216/625$. At least one= $1-P(\text{none})=1-(3/5)^4=544/625$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 14 • Completion and retest record

HP8D - Repeated-event probability

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 15****HP9A - Conditional probability from tables****Chapter purpose**

Restrict the sample space correctly and calculate given-that probabilities from two-way tables.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 15 • Method and assessment map

HP9A - Conditional probability from tables

Specification focus

Restrict the sample space correctly and calculate given-that probabilities from two-way tables.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 15 • Practice

HP9A - Conditional probability from tables • Questions 1-2

Q01 | 4 MARKS

A two-way table represents 310 people. There are 80 in A, 102 in B and 40 in both. Calculate $P(A \text{ given } B)$, $P(B \text{ given } A)$, and explain why these conditional probabilities need not be equal. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A two-way table represents 340 people. There are 83 in A, 73 in B and 43 in both. Calculate $P(A \text{ given } B)$, $P(B \text{ given } A)$, and explain why these conditional probabilities need not be equal. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HP9A - Conditional probability from tables • Questions 3-4

Q03 | 4 MARKS

A two-way table represents 370 people. There are 86 in A, 79 in B and 46 in both. Calculate $P(A \text{ given } B)$, $P(B \text{ given } A)$, and explain why these conditional probabilities need not be equal. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A two-way table represents 400 people. There are 89 in A, 85 in B and 27 in both. Calculate $P(A \text{ given } B)$, $P(B \text{ given } A)$, and explain why these conditional probabilities need not be equal. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HP9A - Conditional probability from tables • Questions 5-6

Q05 | 4 MARKS

A two-way table represents 430 people. There are 92 in A, 91 in B and 30 in both. Calculate $P(A \text{ given } B)$, $P(B \text{ given } A)$, and explain why these conditional probabilities need not be equal. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A two-way table represents 460 people. There are 95 in A, 97 in B and 33 in both. Calculate $P(A \text{ given } B)$, $P(B \text{ given } A)$, and explain why these conditional probabilities need not be equal. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HP9A - Conditional probability from tables • Questions 7-8

Q07 | 4 MARKS

A two-way table represents 490 people. There are 98 in A, 103 in B and 36 in both. Calculate $P(A \text{ given } B)$, $P(B \text{ given } A)$, and explain why these conditional probabilities need not be equal. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A two-way table represents 520 people. There are 66 in A, 74 in B and 39 in both. Calculate $P(A \text{ given } B)$, $P(B \text{ given } A)$, and explain why these conditional probabilities need not be equal. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HP9A - Conditional probability from tables • Questions 9-10

Q09 | 4 MARKS

A two-way table represents 550 people. There are 69 in A, 80 in B and 42 in both. Calculate $P(A \text{ given } B)$, $P(B \text{ given } A)$, and explain why these conditional probabilities need not be equal. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

A two-way table represents 580 people. There are 72 in A, 86 in B and 45 in both. Calculate $P(A \text{ given } B)$, $P(B \text{ given } A)$, and explain why these conditional probabilities need not be equal. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HP9A - Conditional probability from tables • Questions 11-12

Q11 | 5 MARKS

You must show your working. A two-way table represents 590 people. There are 73 in A, 88 in B and 46 in both. Calculate $P(A \text{ given } B)$, $P(B \text{ given } A)$, and explain why these conditional probabilities need not be equal. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A two-way table represents 600 people. There are 74 in A, 90 in B and 25 in both. Calculate $P(A \text{ given } B)$, $P(B \text{ given } A)$, and explain why these conditional probabilities need not be equal. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 15

HP9A - Conditional probability from tables • Questions 1-2

Q01 | 4 MARKS

Given B restricts the denominator to 102: $P(A \text{ given } B) = 40/102 = 20/51$. Given A restricts it to 80: $P(B \text{ given } A) = 40/80 = 1/2$. The intersection numerator is shared, but the restricted group totals differ. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

Given B restricts the denominator to 73: $P(A \text{ given } B) = 43/73 = 43/73$. Given A restricts it to 83: $P(B \text{ given } A) = 43/83 = 43/83$. The intersection numerator is shared, but the restricted group totals differ. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 15

HP9A - Conditional probability from tables • Questions 3-4

Q03 | 4 MARKS

Given B restricts the denominator to 79: $P(A \text{ given } B) = \frac{46}{79} = \frac{46}{79}$. Given A restricts it to 86: $P(B \text{ given } A) = \frac{46}{86} = \frac{23}{43}$. The intersection numerator is shared, but the restricted group totals differ. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

Given B restricts the denominator to 85: $P(A \text{ given } B) = \frac{27}{85} = \frac{27}{85}$. Given A restricts it to 89: $P(B \text{ given } A) = \frac{27}{89} = \frac{27}{89}$. The intersection numerator is shared, but the restricted group totals differ. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 15

HP9A - Conditional probability from tables • Questions 5-6

Q05 | 4 MARKS

Given B restricts the denominator to 91: $P(A \text{ given } B) = 30/91 = 30/91$. Given A restricts it to 92: $P(B \text{ given } A) = 30/92 = 15/46$. The intersection numerator is shared, but the restricted group totals differ. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

Given B restricts the denominator to 97: $P(A \text{ given } B) = 33/97 = 33/97$. Given A restricts it to 95: $P(B \text{ given } A) = 33/95 = 33/95$. The intersection numerator is shared, but the restricted group totals differ. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 15

HP9A - Conditional probability from tables • Questions 7-8

Q07 | 4 MARKS

Given B restricts the denominator to 103: $P(A \text{ given } B) = 36/103 = 36/103$. Given A restricts it to 98: $P(B \text{ given } A) = 36/98 = 18/49$. The intersection numerator is shared, but the restricted group totals differ. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

Given B restricts the denominator to 74: $P(A \text{ given } B) = 39/74 = 39/74$. Given A restricts it to 66: $P(B \text{ given } A) = 39/66 = 13/22$. The intersection numerator is shared, but the restricted group totals differ. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 15

HP9A - Conditional probability from tables • Questions 9-10

Q09 | 4 MARKS

Given B restricts the denominator to 80: $P(A \text{ given } B) = 42/80 = 21/40$. Given A restricts it to 69: $P(B \text{ given } A) = 42/69 = 14/23$. The intersection numerator is shared, but the restricted group totals differ. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

Given B restricts the denominator to 86: $P(A \text{ given } B) = 45/86 = 45/86$. Given A restricts it to 72: $P(B \text{ given } A) = 45/72 = 5/8$. The intersection numerator is shared, but the restricted group totals differ. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 15

HP9A - Conditional probability from tables • Questions 11-12

Q11 | 5 MARKS

Given B restricts the denominator to 88: $P(A \text{ given } B) = 46/88 = 23/44$. Given A restricts it to 73: $P(B \text{ given } A) = 46/73 = 46/73$. The intersection numerator is shared, but the restricted group totals differ. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

Given B restricts the denominator to 90: $P(A \text{ given } B) = 25/90 = 5/18$. Given A restricts it to 74: $P(B \text{ given } A) = 25/74 = 25/74$. The intersection numerator is shared, but the restricted group totals differ. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 15 • Completion and retest record

HP9A - Conditional probability from tables

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 16****HP9B - Conditional probability from Venn diagrams****Chapter purpose**

Interpret intersections inside a restricted set and distinguish reverse conditional probabilities.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 16 • Method and assessment map

HP9B - Conditional probability from Venn diagrams

Specification focus

Interpret intersections inside a restricted set and distinguish reverse conditional probabilities.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 16 • Practice

HP9B - Conditional probability from Venn diagrams • Questions 1-2

Q01 | 4 MARKS

A Venn diagram has universal total 215, $n(A)=75$, $n(B)=60$ and $n(A \text{ intersection } B)=35$. Find $P(A \text{ given } B)$, $P(A \text{ complement given } B)$, and $P(B \text{ given } A \text{ union } B)$. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A Venn diagram has universal total 230, $n(A)=78$, $n(B)=66$ and $n(A \text{ intersection } B)=38$. Find $P(A \text{ given } B)$, $P(A \text{ complement given } B)$, and $P(B \text{ given } A \text{ union } B)$. Your solution must justify the main method or assumption and include a final check.

Chapter 16 • Practice

HP9B - Conditional probability from Venn diagrams • Questions 3-4

Q03 | 4 MARKS

A Venn diagram has universal total 245, $n(A)=81$, $n(B)=72$ and $n(A \text{ intersection } B)=21$. Find $P(A \text{ given } B)$, $P(A \text{ complement given } B)$, and $P(B \text{ given } A \text{ union } B)$. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A Venn diagram has universal total 260, $n(A)=84$, $n(B)=78$ and $n(A \text{ intersection } B)=24$. Find $P(A \text{ given } B)$, $P(A \text{ complement given } B)$, and $P(B \text{ given } A \text{ union } B)$. Your solution must justify the main method or assumption and include a final check.

Chapter 16 • Practice

HP9B - Conditional probability from Venn diagrams • Questions 5-6

Q05 | 4 MARKS

A Venn diagram has universal total 275, $n(A)=87$, $n(B)=84$ and $n(A \text{ intersection } B)=27$. Find $P(A \text{ given } B)$, $P(A \text{ complement given } B)$, and $P(B \text{ given } A \text{ union } B)$. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A Venn diagram has universal total 290, $n(A)=60$, $n(B)=62$ and $n(A \text{ intersection } B)=30$. Find $P(A \text{ given } B)$, $P(A \text{ complement given } B)$, and $P(B \text{ given } A \text{ union } B)$. Your solution must justify the main method or assumption and include a final check.

Chapter 16 • Practice

HP9B - Conditional probability from Venn diagrams • Questions 7-8

Q07 | 4 MARKS

A Venn diagram has universal total 305, $n(A)=63$, $n(B)=68$ and $n(A \text{ intersection } B)=33$. Find $P(A \text{ given } B)$, $P(A \text{ complement given } B)$, and $P(B \text{ given } A \text{ union } B)$. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A Venn diagram has universal total 320, $n(A)=66$, $n(B)=74$ and $n(A \text{ intersection } B)=36$. Find $P(A \text{ given } B)$, $P(A \text{ complement given } B)$, and $P(B \text{ given } A \text{ union } B)$. Your solution must justify the main method or assumption and include a final check.

Chapter 16 • Practice

HP9B - Conditional probability from Venn diagrams • Questions 9-10

Q09 | 4 MARKS

A Venn diagram has universal total 335, $n(A)=69$, $n(B)=80$ and $n(A \text{ intersection } B)=39$. Find $P(A \text{ given } B)$, $P(A \text{ complement given } B)$, and $P(B \text{ given } A \text{ union } B)$. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

A Venn diagram has universal total 350, $n(A)=72$, $n(B)=58$ and $n(A \text{ intersection } B)=22$. Find $P(A \text{ given } B)$, $P(A \text{ complement given } B)$, and $P(B \text{ given } A \text{ union } B)$. Your solution must justify the main method or assumption and include a final check.

Chapter 16 • Practice

HP9B - Conditional probability from Venn diagrams • Questions 11-12

Q11 | 5 MARKS

You must show your working. A Venn diagram has universal total 355, $n(A)=73$, $n(B)=60$ and $n(A \cap B)=23$. Find $P(A \text{ given } B)$, $P(A \text{ complement given } B)$, and $P(B \text{ given } A \cup B)$. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A Venn diagram has universal total 360, $n(A)=74$, $n(B)=62$ and $n(A \cap B)=24$. Find $P(A \text{ given } B)$, $P(A \text{ complement given } B)$, and $P(B \text{ given } A \cup B)$. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 16

HP9B - Conditional probability from Venn diagrams • Questions 1-2

Q01 | 4 MARKS

Within B, 35 are also in A, so $P(A \text{ given } B) = 7/12$. The remaining B-only count is 25, giving $P(A \text{ complement given } B) = 5/12$. Within A union B (100 members), 60 are in B, so $P(B \text{ given } A \text{ union } B) = 3/5$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

Within B, 38 are also in A, so $P(A \text{ given } B) = 19/33$. The remaining B-only count is 28, giving $P(A \text{ complement given } B) = 14/33$. Within A union B (106 members), 66 are in B, so $P(B \text{ given } A \text{ union } B) = 33/53$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 16

HP9B - Conditional probability from Venn diagrams • Questions 3-4

Q03 | 4 MARKS

Within B, 21 are also in A, so $P(A \text{ given } B) = 7/24$. The remaining B-only count is 51, giving $P(A \text{ complement given } B) = 17/24$. Within A union B (132 members), 72 are in B, so $P(B \text{ given } A \text{ union } B) = 6/11$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

Within B, 24 are also in A, so $P(A \text{ given } B) = 4/13$. The remaining B-only count is 54, giving $P(A \text{ complement given } B) = 9/13$. Within A union B (138 members), 78 are in B, so $P(B \text{ given } A \text{ union } B) = 13/23$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 16

HP9B - Conditional probability from Venn diagrams • Questions 5-6

Q05 | 4 MARKS

Within B, 27 are also in A, so $P(A \text{ given } B) = 9/28$. The remaining B-only count is 57, giving $P(A \text{ complement given } B) = 19/28$. Within A union B (144 members), 84 are in B, so $P(B \text{ given } A \text{ union } B) = 7/12$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

Within B, 30 are also in A, so $P(A \text{ given } B) = 15/31$. The remaining B-only count is 32, giving $P(A \text{ complement given } B) = 16/31$. Within A union B (92 members), 62 are in B, so $P(B \text{ given } A \text{ union } B) = 31/46$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 16

HP9B - Conditional probability from Venn diagrams • Questions 7-8

Q07 | 4 MARKS

Within B, 33 are also in A, so $P(A \text{ given } B) = 33/68$. The remaining B-only count is 35, giving $P(A \text{ complement given } B) = 35/68$. Within A union B (98 members), 68 are in B, so $P(B \text{ given } A \text{ union } B) = 68/98$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

Within B, 36 are also in A, so $P(A \text{ given } B) = 36/74$. The remaining B-only count is 38, giving $P(A \text{ complement given } B) = 38/74$. Within A union B (104 members), 74 are in B, so $P(B \text{ given } A \text{ union } B) = 74/104$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 16

HP9B - Conditional probability from Venn diagrams • Questions 9-10

Q09 | 4 MARKS

Within B, 39 are also in A, so $P(A \text{ given } B) = 39/80$. The remaining B-only count is 41, giving $P(A \text{ complement given } B) = 41/80$. Within A union B (110 members), 80 are in B, so $P(B \text{ given } A \text{ union } B) = 8/11$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

Within B, 22 are also in A, so $P(A \text{ given } B) = 11/29$. The remaining B-only count is 36, giving $P(A \text{ complement given } B) = 18/29$. Within A union B (108 members), 58 are in B, so $P(B \text{ given } A \text{ union } B) = 29/54$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 16

HP9B - Conditional probability from Venn diagrams • Questions 11-12

Q11 | 5 MARKS

Within B, 23 are also in A, so $P(A \text{ given } B) = 23/60$. The remaining B-only count is 37, giving $P(A \text{ complement given } B) = 37/60$. Within A union B (110 members), 60 are in B, so $P(B \text{ given } A \text{ union } B) = 6/11$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

Within B, 24 are also in A, so $P(A \text{ given } B) = 12/31$. The remaining B-only count is 38, giving $P(A \text{ complement given } B) = 19/31$. Within A union B (112 members), 62 are in B, so $P(B \text{ given } A \text{ union } B) = 31/56$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 16 • Completion and retest record

HP9B - Conditional probability from Venn diagrams

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 17****HP9C - Conditional probability on trees****Chapter purpose**

Read forward conditional branches and reverse evidence using complete path probabilities.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 17 • Method and assessment map

HP9C - Conditional probability on trees

Specification focus

Read forward conditional branches and reverse evidence using complete path probabilities.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 17 • Practice

HP9C - Conditional probability on trees • Questions 1-2

Q01 | 4 MARKS

$P(\text{condition}) = \frac{3}{5}$. A test is positive with probability $\frac{7}{10}$ when the condition is present and $\frac{1}{5}$ when absent. Find $P(\text{positive})$, then $P(\text{condition given positive})$, using a probability tree. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

$P(\text{condition}) = \frac{1}{2}$. A test is positive with probability $\frac{7}{10}$ when the condition is present and $\frac{1}{10}$ when absent. Find $P(\text{positive})$, then $P(\text{condition given positive})$, using a probability tree. Your solution must justify the main method or assumption and include a final check.

Chapter 17 • Practice

HP9C - Conditional probability on trees • Questions 3-4

Q03 | 4 MARKS

$P(\text{condition}) = 2/5$. A test is positive with probability $7/10$ when the condition is present and $1/5$ when absent. Find $P(\text{positive})$, then $P(\text{condition given positive})$, using a probability tree. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

$P(\text{condition}) = 3/10$. A test is positive with probability $7/10$ when the condition is present and $1/10$ when absent. Find $P(\text{positive})$, then $P(\text{condition given positive})$, using a probability tree. Your solution must justify the main method or assumption and include a final check.

Chapter 17 • Practice

HP9C - Conditional probability on trees • Questions 5-6

Q05 | 4 MARKS

$P(\text{condition}) = \frac{3}{5}$. A test is positive with probability $\frac{7}{10}$ when the condition is present and $\frac{1}{5}$ when absent. Find $P(\text{positive})$, then $P(\text{condition given positive})$, using a probability tree. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Q06 | 4 MARKS

$P(\text{condition}) = \frac{1}{2}$. A test is positive with probability $\frac{7}{10}$ when the condition is present and $\frac{1}{10}$ when absent. Find $P(\text{positive})$, then $P(\text{condition given positive})$, using a probability tree. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Chapter 17 • Practice

HP9C - Conditional probability on trees • Questions 7-8

Q07 | 4 MARKS

$P(\text{condition}) = \frac{2}{5}$. A test is positive with probability $\frac{7}{10}$ when the condition is present and $\frac{1}{5}$ when absent. Find $P(\text{positive})$, then $P(\text{condition given positive})$, using a probability tree. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Q08 | 4 MARKS

$P(\text{condition}) = \frac{3}{10}$. A test is positive with probability $\frac{7}{10}$ when the condition is present and $\frac{1}{10}$ when absent. Find $P(\text{positive})$, then $P(\text{condition given positive})$, using a probability tree. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Chapter 17 • Practice

HP9C - Conditional probability on trees • Questions 9-10

Q09 | 4 MARKS

$P(\text{condition}) = \frac{3}{5}$. A test is positive with probability $\frac{7}{10}$ when the condition is present and $\frac{1}{5}$ when absent. Find $P(\text{positive})$, then $P(\text{condition given positive})$, using a probability tree. Your solution must justify the main method or assumption and include a final check. Identify the key condition you used and explain why it applies here.

Q10 | 4 MARKS

$P(\text{condition}) = \frac{1}{2}$. A test is positive with probability $\frac{7}{10}$ when the condition is present and $\frac{1}{10}$ when absent. Find $P(\text{positive})$, then $P(\text{condition given positive})$, using a probability tree. Your solution must justify the main method or assumption and include a final check. Identify the key condition you used and explain why it applies here.

Chapter 17 • Practice

HP9C - Conditional probability on trees • Questions 11-12

Q11 | 5 MARKS

You must show your working. $P(\text{condition}) = \frac{3}{5}$. A test is positive with probability $\frac{4}{5}$ when the condition is present and $\frac{1}{5}$ when absent. Find $P(\text{positive})$, then $P(\text{condition given positive})$, using a probability tree. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. $P(\text{condition}) = \frac{3}{10}$. A test is positive with probability $\frac{9}{10}$ when the condition is present and $\frac{1}{10}$ when absent. Find $P(\text{positive})$, then $P(\text{condition given positive})$, using a probability tree. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 17

HP9C - Conditional probability on trees • Questions 1-2

Q01 | 4 MARKS

Positive paths are condition-and-positive plus no-condition-and-positive: $\frac{3}{5} \times \frac{7}{10} + \frac{2}{5} \times \frac{1}{5} = \frac{1}{2}$. Restricting to positive outcomes gives $P(\text{condition given positive}) = (\frac{3}{5} \times \frac{7}{10}) / \frac{1}{2} = \frac{21}{25}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

Positive paths are condition-and-positive plus no-condition-and-positive: $\frac{1}{2} \times \frac{7}{10} + \frac{1}{2} \times \frac{1}{10} = \frac{2}{5}$. Restricting to positive outcomes gives $P(\text{condition given positive}) = (\frac{1}{2} \times \frac{7}{10}) / \frac{2}{5} = \frac{7}{8}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 17

HP9C - Conditional probability on trees • Questions 3-4

Q03 | 4 MARKS

Positive paths are condition-and-positive plus no-condition-and-positive: $\frac{2}{5} \times \frac{7}{10} + \frac{3}{5} \times \frac{1}{5} = \frac{2}{5}$. Restricting to positive outcomes gives $P(\text{condition given positive}) = (\frac{2}{5} \times \frac{7}{10}) / \frac{2}{5} = \frac{7}{10}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

Positive paths are condition-and-positive plus no-condition-and-positive: $\frac{3}{10} \times \frac{7}{10} + \frac{7}{10} \times \frac{1}{10} = \frac{7}{25}$. Restricting to positive outcomes gives $P(\text{condition given positive}) = (\frac{3}{10} \times \frac{7}{10}) / \frac{7}{25} = \frac{3}{4}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 17

HP9C - Conditional probability on trees • Questions 5-6

Q05 | 4 MARKS

Positive paths are condition-and-positive plus no-condition-and-positive: $\frac{3}{5} \times \frac{7}{10} + \frac{2}{5} \times \frac{1}{5} = \frac{1}{2}$. Restricting to positive outcomes gives $P(\text{condition given positive}) = (\frac{3}{5} \times \frac{7}{10}) / \frac{1}{2} = \frac{21}{25}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

Positive paths are condition-and-positive plus no-condition-and-positive: $\frac{1}{2} \times \frac{7}{10} + \frac{1}{2} \times \frac{1}{10} = \frac{2}{5}$. Restricting to positive outcomes gives $P(\text{condition given positive}) = (\frac{1}{2} \times \frac{7}{10}) / \frac{2}{5} = \frac{7}{8}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 17

HP9C - Conditional probability on trees • Questions 7-8

Q07 | 4 MARKS

Positive paths are condition-and-positive plus no-condition-and-positive: $\frac{2}{5} \times \frac{7}{10} + \frac{3}{5} \times \frac{1}{5} = \frac{2}{5}$. Restricting to positive outcomes gives $P(\text{condition given positive}) = (\frac{2}{5} \times \frac{7}{10}) / \frac{2}{5} = \frac{7}{10}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

Positive paths are condition-and-positive plus no-condition-and-positive: $\frac{3}{10} \times \frac{7}{10} + \frac{7}{10} \times \frac{1}{10} = \frac{7}{25}$. Restricting to positive outcomes gives $P(\text{condition given positive}) = (\frac{3}{10} \times \frac{7}{10}) / \frac{7}{25} = \frac{3}{4}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 17

HP9C - Conditional probability on trees • Questions 9-10

Q09 | 4 MARKS

Positive paths are condition-and-positive plus no-condition-and-positive: $\frac{3}{5} \times \frac{7}{10} + \frac{2}{5} \times \frac{1}{5} = \frac{1}{2}$. Restricting to positive outcomes gives $P(\text{condition given positive}) = (\frac{3}{5} \times \frac{7}{10}) / \frac{1}{2} = \frac{21}{25}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The explanation must name the relevant condition and link it explicitly to the method used.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

Positive paths are condition-and-positive plus no-condition-and-positive: $\frac{1}{2} \times \frac{7}{10} + \frac{1}{2} \times \frac{1}{10} = \frac{2}{5}$. Restricting to positive outcomes gives $P(\text{condition given positive}) = (\frac{1}{2} \times \frac{7}{10}) / \frac{2}{5} = \frac{7}{8}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The explanation must name the relevant condition and link it explicitly to the method used.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 17

HP9C - Conditional probability on trees • Questions 11-12

Q11 | 5 MARKS

Positive paths are condition-and-positive plus no-condition-and-positive: $\frac{3}{5} \times \frac{4}{5} + \frac{2}{5} \times \frac{1}{5} = \frac{14}{25}$. Restricting to positive outcomes gives $P(\text{condition given positive}) = (\frac{3}{5} \times \frac{4}{5}) / \frac{14}{25} = \frac{6}{7}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

Positive paths are condition-and-positive plus no-condition-and-positive: $\frac{3}{10} \times \frac{9}{10} + \frac{7}{10} \times \frac{1}{10} = \frac{17}{50}$. Restricting to positive outcomes gives $P(\text{condition given positive}) = (\frac{3}{10} \times \frac{9}{10}) / \frac{17}{50} = \frac{27}{34}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 17 • Completion and retest record

HP9C - Conditional probability on trees

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 5 • CHAPTER 18****HP9D - Reverse and algebraic probability****Chapter purpose**

Form equations from unknown probabilities, solve them and reject invalid probability values.

Higher reasoning expectation

Select methods independently, connect representations, justify assumptions and verify conclusions.
Questions 9–12 provide the chapter stretch sequence.

Chapter 18 • Method and assessment map

HP9D - Reverse and algebraic probability

Specification focus

Form equations from unknown probabilities, solve them and reject invalid probability values.

Method routine

Identify the mathematical structure; record assumptions and units; carry out an exact or controlled calculation; then verify by inverse work, substitution, estimation or a second representation.

Marking principle

Award method, accuracy, reasoning and final interpretation only where the question requires them. Equivalent valid methods should receive credit.

Calculator choice

Content may be assessed on either Eduqas component. Students should decide whether technology supports rather than replaces reasoning.

Chapter 18 • Practice

HP9D - Reverse and algebraic probability • Questions 1-2

Q01 | 4 MARKS

A two-stage game uses $P(A)=p$. If A occurs, $P(\text{win})=3/5$; if A does not occur, $P(\text{win})=2/5$. The overall probability of winning is $1/2$. Form and solve an equation for p , then check that your answer is a valid probability. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A two-stage game uses $P(A)=p$. If A occurs, $P(\text{win})=3/4$; if A does not occur, $P(\text{win})=1/4$. The overall probability of winning is $1/2$. Form and solve an equation for p , then check that your answer is a valid probability. Your solution must justify the main method or assumption and include a final check.

Chapter 18 • Practice

HP9D - Reverse and algebraic probability • Questions 3-4

Q03 | 4 MARKS

A two-stage game uses $P(A)=p$. If A occurs, $P(\text{win})=2/3$; if A does not occur, $P(\text{win})=1/3$. The overall probability of winning is $1/2$. Form and solve an equation for p , then check that your answer is a valid probability. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A two-stage game uses $P(A)=p$. If A occurs, $P(\text{win})=7/9$; if A does not occur, $P(\text{win})=2/9$. The overall probability of winning is $1/2$. Form and solve an equation for p , then check that your answer is a valid probability. Your solution must justify the main method or assumption and include a final check.

Chapter 18 • Practice

HP9D - Reverse and algebraic probability • Questions 5-6

Q05 | 4 MARKS

A two-stage game uses $P(A)=p$. If A occurs, $P(\text{win})=5/7$; if A does not occur, $P(\text{win})=2/7$. The overall probability of winning is $1/2$. Form and solve an equation for p , then check that your answer is a valid probability. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A two-stage game uses $P(A)=p$. If A occurs, $P(\text{win})=3/5$; if A does not occur, $P(\text{win})=2/5$. The overall probability of winning is $1/2$. Form and solve an equation for p , then check that your answer is a valid probability. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Chapter 18 • Practice

HP9D - Reverse and algebraic probability • Questions 7-8

Q07 | 4 MARKS

A two-stage game uses $P(A)=p$. If A occurs, $P(\text{win})=3/4$; if A does not occur, $P(\text{win})=1/4$. The overall probability of winning is $1/2$. Form and solve an equation for p , then check that your answer is a valid probability. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Q08 | 4 MARKS

A two-stage game uses $P(A)=p$. If A occurs, $P(\text{win})=2/3$; if A does not occur, $P(\text{win})=1/3$. The overall probability of winning is $1/2$. Form and solve an equation for p , then check that your answer is a valid probability. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Chapter 18 • Practice

HP9D - Reverse and algebraic probability • Questions 9-10

Q09 | 4 MARKS

A two-stage game uses $P(A)=p$. If A occurs, $P(\text{win})=7/9$; if A does not occur, $P(\text{win})=2/9$. The overall probability of winning is $1/2$. Form and solve an equation for p , then check that your answer is a valid probability. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Q10 | 4 MARKS

A two-stage game uses $P(A)=p$. If A occurs, $P(\text{win})=5/7$; if A does not occur, $P(\text{win})=2/7$. The overall probability of winning is $1/2$. Form and solve an equation for p , then check that your answer is a valid probability. Your solution must justify the main method or assumption and include a final check. After completing the calculation, give one independent check that supports your result.

Chapter 18 • Practice

HP9D - Reverse and algebraic probability • Questions 11-12

Q11 | 5 MARKS

You must show your working. A two-stage game uses $P(A)=p$. If A occurs, $P(\text{win})=3/4$; if A does not occur, $P(\text{win})=1/4$. The overall probability of winning is $1/2$. Form and solve an equation for p , then check that your answer is a valid probability. Your solution must justify the main method or assumption and include a final check. Identify the key condition you used and explain why it applies here.

Q12 | 6 MARKS

You must show your working. A two-stage game uses $P(A)=p$. If A occurs, $P(\text{win})=7/9$; if A does not occur, $P(\text{win})=2/9$. The overall probability of winning is $1/2$. Form and solve an equation for p , then check that your answer is a valid probability. Your solution must justify the main method or assumption and include a final check. Identify the key condition you used and explain why it applies here.

Worked solutions • Chapter 18

HP9D - Reverse and algebraic probability • Questions 1-2

Q01 | 4 MARKS

Total probability gives $p(3/5) + (1-p)(2/5) = 1/2$. Expanding and solving gives $p = 1/2$. Since $0 \leq 1/2 \leq 1$ and substitution recreates $1/2$, it is valid. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q01.

Q02 | 4 MARKS

Total probability gives $p(3/4) + (1-p)(1/4) = 1/2$. Expanding and solving gives $p = 1/2$. Since $0 \leq 1/2 \leq 1$ and substitution recreates $1/2$, it is valid. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q02.

Worked solutions • Chapter 18

HP9D - Reverse and algebraic probability • Questions 3-4

Q03 | 4 MARKS

Total probability gives $p(2/3) + (1-p)(1/3) = 1/2$. Expanding and solving gives $p = 1/2$. Since $0 \leq 1/2 \leq 1$ and substitution recreates $1/2$, it is valid. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q03.

Q04 | 4 MARKS

Total probability gives $p(7/9) + (1-p)(2/9) = 1/2$. Expanding and solving gives $p = 1/2$. Since $0 \leq 1/2 \leq 1$ and substitution recreates $1/2$, it is valid. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q04.

Worked solutions • Chapter 18

HP9D - Reverse and algebraic probability • Questions 5-6

Q05 | 4 MARKS

Total probability gives $p(5/7) + (1-p)(2/7) = 1/2$. Expanding and solving gives $p = 1/2$. Since $0 \leq 1/2 \leq 1$ and substitution recreates $1/2$, it is valid. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q05.

Q06 | 4 MARKS

Total probability gives $p(3/5) + (1-p)(2/5) = 1/2$. Expanding and solving gives $p = 1/2$. Since $0 \leq 1/2 \leq 1$ and substitution recreates $1/2$, it is valid. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q06.

Worked solutions • Chapter 18

HP9D - Reverse and algebraic probability • Questions 7-8

Q07 | 4 MARKS

Total probability gives $p(3/4) + (1-p)(1/4) = 1/2$. Expanding and solving gives $p = 1/2$. Since $0 \leq 1/2 \leq 1$ and substitution recreates $1/2$, it is valid. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q07.

Q08 | 4 MARKS

Total probability gives $p(2/3) + (1-p)(1/3) = 1/2$. Expanding and solving gives $p = 1/2$. Since $0 \leq 1/2 \leq 1$ and substitution recreates $1/2$, it is valid. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q08.

Worked solutions • Chapter 18

HP9D - Reverse and algebraic probability • Questions 9-10

Q09 | 4 MARKS

Total probability gives $p(7/9) + (1-p)(2/9) = 1/2$. Expanding and solving gives $p = 1/2$. Since $0 \leq 1/2 \leq 1$ and substitution recreates $1/2$, it is valid. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q09.

Q10 | 4 MARKS

Total probability gives $p(5/7) + (1-p)(2/7) = 1/2$. Expanding and solving gives $p = 1/2$. Since $0 \leq 1/2 \leq 1$ and substitution recreates $1/2$, it is valid. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. A valid independent check uses substitution, an inverse operation, estimation, or the defining property as appropriate.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q10.

Worked solutions • Chapter 18

HP9D - Reverse and algebraic probability • Questions 11-12

Q11 | 5 MARKS

Total probability gives $p(3/4) + (1-p)(1/4) = 1/2$. Expanding and solving gives $p = 1/2$. Since $0 \leq 1/2 \leq 1$ and substitution recreates $1/2$, it is valid. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The explanation must name the relevant condition and link it explicitly to the method used.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q11.

Q12 | 6 MARKS

Total probability gives $p(7/9) + (1-p)(2/9) = 1/2$. Expanding and solving gives $p = 1/2$. Since $0 \leq 1/2 \leq 1$ and substitution recreates $1/2$, it is valid. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. The explanation must name the relevant condition and link it explicitly to the method used.

Item-specific marking check

Credit the principal method and accurate progress. Reserve any reasoning or checking mark for a statement that answers the explicit demand of Q12.

Chapter 18 • Completion and retest record

HP9D - Reverse and algebraic probability

Question	1	2	3	4	5	6	7	8	9	10	11	12
Score												
Retest												

Reflection

Which decision, representation or proof step should you practise again?

Teacher / reviewer: _____ Date: _____