

GCSE MATHEMATICS

HIGHER TIER

UNIT 2: ALGEBRA

CORRECTED PUBLICATION EDITION

25 chapters • 300 questions • 4–6 marks • complete worked solutions

Student: _____

Independent publication notice

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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 2 • CHAPTER 1****HA1 - Algebraic notation****Chapter purpose**

Interpret coefficients, powers, products, quotients, fractions and brackets accurately.

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

HA1 - Algebraic notation

Specification focus

Interpret coefficients, powers, products, quotients, fractions and brackets accurately.

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

HA1 - Algebraic notation • Questions 1-2

Q01 | 4 MARKS

For $x=3$, evaluate $3x^2 - x + 10$. Show substitution with brackets and check the sign of the squared term. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

For $x=-3$, evaluate $6x^2 - 4x + 5$. Show substitution with brackets and check the sign of the squared term. Your solution must justify the main method or assumption and include a final check.

Chapter 1 • Practice

HA1 - Algebraic notation • Questions 3-4

Q03 | 4 MARKS

For $x=0$, evaluate $2x^2 - 2x + 8$. Show substitution with brackets and check the sign of the squared term. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

For $x=3$, evaluate $5x^2 - 5x + 3$. Show substitution with brackets and check the sign of the squared term. Your solution must justify the main method or assumption and include a final check.

Chapter 1 • Practice

HA1 - Algebraic notation • Questions 5-6

Q05 | 4 MARKS

For $x=-3$, evaluate $8x^2 - 3x + 6$. Show substitution with brackets and check the sign of the squared term. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

For $x=0$, evaluate $4x^2 - x + 9$. Show substitution with brackets and check the sign of the squared term. Your solution must justify the main method or assumption and include a final check.

Chapter 1 • Practice

HA1 - Algebraic notation • Questions 7-8

Q07 | 4 MARKS

For $x=3$, evaluate $7x^2 - 4x + 4$. Show substitution with brackets and check the sign of the squared term. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

For $x=-3$, evaluate $3x^2 - 2x + 7$. Show substitution with brackets and check the sign of the squared term. Your solution must justify the main method or assumption and include a final check.

Chapter 1 • Practice

HA1 - Algebraic notation • Questions 9-10

Q09 | 4 MARKS

For $x=0$, evaluate $6x^2 - 5x + 10$. Show substitution with brackets and check the sign of the squared term. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

For $x=3$, evaluate $2x^2 - 3x + 5$. Show substitution with brackets and check the sign of the squared term. Your solution must justify the main method or assumption and include a final check.

Chapter 1 • Practice

HA1 - Algebraic notation • Questions 11-12

Q11 | 5 MARKS

You must show your working. For $x=4$, evaluate $3x^2 - 4x + 6$. Show substitution with brackets and check the sign of the squared term. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. For $x=5$, evaluate $4x^2 - 5x + 7$. Show substitution with brackets and check the sign of the squared term. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 1

HA1 - Algebraic notation • Questions 1-2

Q01 | 4 MARKS

Substitute $x=3$: $3(3)^2-1(3)+10=34$. Therefore the exact value is 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 Q01.

Q02 | 4 MARKS

Substitute $x=-3$: $6(-3)^2-4(-3)+5=71$. Therefore the exact value is 71. 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

HA1 - Algebraic notation • Questions 3-4

Q03 | 4 MARKS

Substitute $x=0$: $2(0)^2-2(0)+8=8$. Therefore the exact value is 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 Q03.

Q04 | 4 MARKS

Substitute $x=3$: $5(3)^2-5(3)+3=33$. Therefore the exact value is 33. 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

HA1 - Algebraic notation • Questions 5-6

Q05 | 4 MARKS

Substitute $x=-3$: $8(-3)^2-3(-3)+6=87$. Therefore the exact value is 87. 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

Substitute $x=0$: $4(0)^2-1(0)+9=9$. Therefore the exact value is 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 1

HA1 - Algebraic notation • Questions 7-8

Q07 | 4 MARKS

Substitute $x=3$: $7(3)^2-4(3)+4=55$. Therefore the exact value is 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 Q07.

Q08 | 4 MARKS

Substitute $x=-3$: $3(-3)^2-2(-3)+7=40$. Therefore the exact value is 40. 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

HA1 - Algebraic notation • Questions 9-10

Q09 | 4 MARKS

Substitute $x=0$: $6(0)^2-5(0)+10=10$. Therefore the exact value is 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 Q09.

Q10 | 4 MARKS

Substitute $x=3$: $2(3)^2-3(3)+5=14$. Therefore the exact value is 14. 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

HA1 - Algebraic notation • Questions 11-12

Q11 | 5 MARKS

Substitute $x=4$: $3(4)^2-4(4)+6=38$. Therefore the exact value is 38. 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

Substitute $x=5$: $4(5)^2-5(5)+7=82$. Therefore the exact value is 82. 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

HA1 - Algebraic notation

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 2 • CHAPTER 2****HA2 - Substitution****Chapter purpose**

Substitute into mathematical and scientific formulae, preserving operation order and exact values.

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

HA2 - Substitution

Specification focus

Substitute into mathematical and scientific formulae, preserving operation order and exact 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 2 • Practice

HA2 - Substitution • Questions 1-2

Q01 | 4 MARKS

For $x=3$, evaluate $3x^2 - x + 10$. Show substitution with brackets and check the sign of the squared term. Include one exact substitution check. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

For $x=-3$, evaluate $6x^2 - 4x + 5$. Show substitution with brackets and check the sign of the squared term. Include one exact substitution check. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HA2 - Substitution • Questions 3-4

Q03 | 4 MARKS

For $x=0$, evaluate $2x^2 - 2x + 8$. Show substitution with brackets and check the sign of the squared term. Include one exact substitution check. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

For $x=3$, evaluate $5x^2 - 5x + 3$. Show substitution with brackets and check the sign of the squared term. Include one exact substitution check. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HA2 - Substitution • Questions 5-6

Q05 | 4 MARKS

For $x=-3$, evaluate $8x^2 - 3x + 6$. Show substitution with brackets and check the sign of the squared term. Include one exact substitution check. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

For $x=0$, evaluate $4x^2 - x + 9$. Show substitution with brackets and check the sign of the squared term. Include one exact substitution check. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HA2 - Substitution • Questions 7-8

Q07 | 4 MARKS

For $x=3$, evaluate $7x^2 - 4x + 4$. Show substitution with brackets and check the sign of the squared term. Include one exact substitution check. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

For $x=-3$, evaluate $3x^2 - 2x + 7$. Show substitution with brackets and check the sign of the squared term. Include one exact substitution check. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HA2 - Substitution • Questions 9-10

Q09 | 4 MARKS

For $x=0$, evaluate $6x^2 - 5x + 10$. Show substitution with brackets and check the sign of the squared term. Include one exact substitution check. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

For $x=3$, evaluate $2x^2 - 3x + 5$. Show substitution with brackets and check the sign of the squared term. Include one exact substitution check. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HA2 - Substitution • Questions 11-12

Q11 | 5 MARKS

You must show your working. For $x=4$, evaluate $3x^2 - 4x + 6$. Show substitution with brackets and check the sign of the squared term. Include one exact substitution check. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. For $x=5$, evaluate $4x^2 - 5x + 7$. Show substitution with brackets and check the sign of the squared term. Include one exact substitution check. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 2

HA2 - Substitution • Questions 1-2

Q01 | 4 MARKS

Substitute $x=3$: $3(3)^2-1(3)+10=34$. Therefore the exact value is 34. Confirm the substitution by evaluating in a second valid order. 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

Substitute $x=-3$: $6(-3)^2-4(-3)+5=71$. Therefore the exact value is 71. Confirm the substitution by evaluating in a second valid order. 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

HA2 - Substitution • Questions 3-4

Q03 | 4 MARKS

Substitute $x=0$: $2(0)^2-2(0)+8=8$. Therefore the exact value is 8. Confirm the substitution by evaluating in a second valid order. 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

Substitute $x=3$: $5(3)^2-5(3)+3=33$. Therefore the exact value is 33. Confirm the substitution by evaluating in a second valid order. 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

HA2 - Substitution • Questions 5-6

Q05 | 4 MARKS

Substitute $x=-3$: $8(-3)^2-3(-3)+6=87$. Therefore the exact value is 87. Confirm the substitution by evaluating in a second valid order. 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

Substitute $x=0$: $4(0)^2-1(0)+9=9$. Therefore the exact value is 9. Confirm the substitution by evaluating in a second valid order. 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

HA2 - Substitution • Questions 7-8

Q07 | 4 MARKS

Substitute $x=3$: $7(3)^2-4(3)+4=55$. Therefore the exact value is 55. Confirm the substitution by evaluating in a second valid order. 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

Substitute $x=-3$: $3(-3)^2-2(-3)+7=40$. Therefore the exact value is 40. Confirm the substitution by evaluating in a second valid order. 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

HA2 - Substitution • Questions 9-10

Q09 | 4 MARKS

Substitute $x=0$: $6(0)^2-5(0)+10=10$. Therefore the exact value is 10. Confirm the substitution by evaluating in a second valid order. 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

Substitute $x=3$: $2(3)^2-3(3)+5=14$. Therefore the exact value is 14. Confirm the substitution by evaluating in a second valid order. 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

HA2 - Substitution • Questions 11-12

Q11 | 5 MARKS

Substitute $x=4$: $3(4)^2-4(4)+6=38$. Therefore the exact value is 38. Confirm the substitution by evaluating in a second valid order. 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

Substitute $x=5$: $4(5)^2-5(5)+7=82$. Therefore the exact value is 82. Confirm the substitution by evaluating in a second valid order. 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

HA2 - Substitution

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 2 • CHAPTER 3****HA3 - Expressions, equations, formulae and identities****Chapter purpose**

Distinguish and use the central vocabulary of algebra.

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

HA3 - Expressions, equations, formulae and identities

Specification focus

Distinguish and use the central vocabulary of algebra.

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

HA3 - Expressions, equations, formulae and identities • Questions 1-2

Q01 | 4 MARKS

Prove algebraically that the difference between the squares of $9k+1$ and $9k-1$ is divisible by 36 for every integer k . Classify each principal algebraic statement used as an expression, equation, formula or identity. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Prove algebraically that the difference between the squares of $4k+1$ and $4k-1$ is divisible by 16 for every integer k . Classify each principal algebraic statement used as an expression, equation, formula or identity. Your solution must justify the main method or assumption and include a final check.

Chapter 3 • Practice

HA3 - Expressions, equations, formulae and identities • Questions 3-4

Q03 | 4 MARKS

Prove algebraically that the difference between the squares of $7k+1$ and $7k-1$ is divisible by 28 for every integer k . Classify each principal algebraic statement used as an expression, equation, formula or identity. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Prove algebraically that the difference between the squares of $2k+1$ and $2k-1$ is divisible by 8 for every integer k . Classify each principal algebraic statement used as an expression, equation, formula or identity. Your solution must justify the main method or assumption and include a final check.

Chapter 3 • Practice

HA3 - Expressions, equations, formulae and identities • Questions 5-6

Q05 | 4 MARKS

Prove algebraically that the difference between the squares of $5k+1$ and $5k-1$ is divisible by 20 for every integer k . Classify each principal algebraic statement used as an expression, equation, formula or identity. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Prove algebraically that the difference between the squares of $8k+1$ and $8k-1$ is divisible by 32 for every integer k . Classify each principal algebraic statement used as an expression, equation, formula or identity. Your solution must justify the main method or assumption and include a final check.

Chapter 3 • Practice

HA3 - Expressions, equations, formulae and identities • Questions 7-8

Q07 | 4 MARKS

Prove algebraically that the difference between the squares of $3k+1$ and $3k-1$ is divisible by 12 for every integer k . Classify each principal algebraic statement used as an expression, equation, formula or identity. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Prove algebraically that the difference between the squares of $6k+1$ and $6k-1$ is divisible by 24 for every integer k . Classify each principal algebraic statement used as an expression, equation, formula or identity. Your solution must justify the main method or assumption and include a final check.

Chapter 3 • Practice

HA3 - Expressions, equations, formulae and identities • Questions 9-10

Q09 | 4 MARKS

Prove algebraically that the difference between the squares of $9k+1$ and $9k-1$ is divisible by 36 for every integer k . Classify each principal algebraic statement used as an expression, equation, formula or identity. 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

Prove algebraically that the difference between the squares of $4k+1$ and $4k-1$ is divisible by 16 for every integer k . Classify each principal algebraic statement used as an expression, equation, formula or identity. 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 3 • Practice

HA3 - Expressions, equations, formulae and identities • Questions 11-12

Q11 | 5 MARKS

You must show your working. Prove algebraically that the difference between the squares of $5k+1$ and $5k-1$ is divisible by 20 for every integer k . Classify each principal algebraic statement used as an expression, equation, formula or identity. 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.

Q12 | 6 MARKS

You must show your working. Prove algebraically that the difference between the squares of $6k+1$ and $6k-1$ is divisible by 24 for every integer k . Classify each principal algebraic statement used as an expression, equation, formula or identity. 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.

Worked solutions • Chapter 3

HA3 - Expressions, equations, formulae and identities • Questions 1-2

Q01 | 4 MARKS

Use difference of squares: $[(9k+1)^2-(9k-1)^2]=[(2)][2(9)k]=36k$. Since k is an integer, the result is divisible by 36. The classification must use the defining feature of each algebraic object. 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

Use difference of squares: $[(4k+1)^2-(4k-1)^2]=[(2)][2(4)k]=16k$. Since k is an integer, the result is divisible by 16. The classification must use the defining feature of each algebraic object. 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

HA3 - Expressions, equations, formulae and identities • Questions 3-4

Q03 | 4 MARKS

Use difference of squares: $[(7k+1)^2 - (7k-1)^2] = [(2)][2(7)k] = 28k$. Since k is an integer, the result is divisible by 28. The classification must use the defining feature of each algebraic object. 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

Use difference of squares: $[(2k+1)^2 - (2k-1)^2] = [(2)][2(2)k] = 8k$. Since k is an integer, the result is divisible by 8. The classification must use the defining feature of each algebraic object. 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

HA3 - Expressions, equations, formulae and identities • Questions 5-6

Q05 | 4 MARKS

Use difference of squares: $[(5k+1)^2-(5k-1)^2]=[(2)][2(5)k]=20k$. Since k is an integer, the result is divisible by 20. The classification must use the defining feature of each algebraic object. 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

Use difference of squares: $[(8k+1)^2-(8k-1)^2]=[(2)][2(8)k]=32k$. Since k is an integer, the result is divisible by 32. The classification must use the defining feature of each algebraic object. 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

HA3 - Expressions, equations, formulae and identities • Questions 7-8

Q07 | 4 MARKS

Use difference of squares: $[(3k+1)^2-(3k-1)^2]=[(2)][2(3)k]=12k$. Since k is an integer, the result is divisible by 12. The classification must use the defining feature of each algebraic object. 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

Use difference of squares: $[(6k+1)^2-(6k-1)^2]=[(2)][2(6)k]=24k$. Since k is an integer, the result is divisible by 24. The classification must use the defining feature of each algebraic object. 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

HA3 - Expressions, equations, formulae and identities • Questions 9-10

Q09 | 4 MARKS

Use difference of squares: $[(9k+1)^2 - (9k-1)^2] = [(2)][2(9)k] = 36k$. Since k is an integer, the result is divisible by 36. The classification must use the defining feature of each algebraic object. 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

Use difference of squares: $[(4k+1)^2 - (4k-1)^2] = [(2)][2(4)k] = 16k$. Since k is an integer, the result is divisible by 16. The classification must use the defining feature of each algebraic object. 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 3

HA3 - Expressions, equations, formulae and identities • Questions 11-12

Q11 | 5 MARKS

Use difference of squares: $[(5k+1)^2 - (5k-1)^2] = [(2)][2(5)k] = 20k$. Since k is an integer, the result is divisible by 20. The classification must use the defining feature of each algebraic object. 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 Q11.

Q12 | 6 MARKS

Use difference of squares: $[(6k+1)^2 - (6k-1)^2] = [(2)][2(6)k] = 24k$. Since k is an integer, the result is divisible by 24. The classification must use the defining feature of each algebraic object. 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 Q12.

Chapter 3 • Completion and retest record

HA3 - Expressions, equations, formulae and identities

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 2 • CHAPTER 4****HA4 - Algebraic manipulation****Chapter purpose**

Simplify, expand and factorise; use indices, surds, algebraic fractions and completing the square.

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

HA4 - Algebraic manipulation

Specification focus

Simplify, expand and factorise; use indices, surds, algebraic fractions and completing the square.

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

HA4 - Algebraic manipulation • Questions 1-2

Q01 | 4 MARKS

Expand $2(x - 2)(x + 4)$, then factorise your result to verify the original structure. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Expand $x - 1(x + 3)$, then factorise your result to verify the original structure. Your solution must justify the main method or assumption and include a final check.

Chapter 4 • Practice

HA4 - Algebraic manipulation • Questions 3-4

Q03 | 4 MARKS

Expand $2(x - 2)(x + 2)$, then factorise your result to verify the original structure. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Expand $x - 1(x + 8)$, then factorise your result to verify the original structure. Your solution must justify the main method or assumption and include a final check.

Chapter 4 • Practice

HA4 - Algebraic manipulation • Questions 5-6

Q05 | 4 MARKS

Expand $2(x - 2)(x + 7)$, then factorise your result to verify the original structure. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Expand $x - 1(x + 6)$, then factorise your result to verify the original structure. Your solution must justify the main method or assumption and include a final check.

Chapter 4 • Practice

HA4 - Algebraic manipulation • Questions 7-8

Q07 | 4 MARKS

Expand $2(x - 2)(x + 5)$, then factorise your result to verify the original structure. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Expand $x - 1(x + 4)$, then factorise your result to verify the original structure. Your solution must justify the main method or assumption and include a final check.

Chapter 4 • Practice

HA4 - Algebraic manipulation • Questions 9-10

Q09 | 4 MARKS

Expand $2(x - 2)(x + 3)$, then factorise your result to verify the original structure. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

Expand $x - 1(x + 2)$, then factorise your result to verify the original structure. Your solution must justify the main method or assumption and include a final check.

Chapter 4 • Practice

HA4 - Algebraic manipulation • Questions 11-12

Q11 | 5 MARKS

You must show your working. Expand $2(x - 1)(x + 4)$, then factorise your result to verify the original structure. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. Expand $x - 3(x + 6)$, then factorise your result to verify the original structure. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 4

HA4 - Algebraic manipulation • Questions 1-2

Q01 | 4 MARKS

Expansion gives $2x^2 + 4x - 16$. To reverse, split or identify the middle term and factorise: $2x^2 + 4x - 16 = (2(x - 2))(x + 4)$. 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 Q01.

Q02 | 4 MARKS

Expansion gives $x^2 + 2x - 3$. To reverse, split or identify the middle term and factorise: $x^2 + 2x - 3 = (x - 1)(x + 3)$. 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

HA4 - Algebraic manipulation • Questions 3-4

Q03 | 4 MARKS

Expansion gives $2x^2 - 8$. To reverse, split or identify the middle term and factorise: $2x^2 - 8 = (2(x - 2))(x + 2)$. 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

Expansion gives $x^2 + 7x - 8$. To reverse, split or identify the middle term and factorise: $x^2 + 7x - 8 = (x - 1)(x + 8)$. 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 Q04.

Worked solutions • Chapter 4

HA4 - Algebraic manipulation • Questions 5-6

Q05 | 4 MARKS

Expansion gives $2x^2 + 10x - 28$. To reverse, split or identify the middle term and factorise: $2x^2 + 10x - 28 = (2x - 2)(x + 7)$. 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 Q05.

Q06 | 4 MARKS

Expansion gives $x^2 + 5x - 6$. To reverse, split or identify the middle term and factorise: $x^2 + 5x - 6 = (x - 1)(x + 6)$. 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 Q06.

Worked solutions • Chapter 4

HA4 - Algebraic manipulation • Questions 7-8

Q07 | 4 MARKS

Expansion gives $2x^2 + 6x - 20$. To reverse, split or identify the middle term and factorise: $2x^2 + 6x - 20 = (2(x - 2))(x + 5)$. 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 Q07.

Q08 | 4 MARKS

Expansion gives $x^2 + 3x - 4$. To reverse, split or identify the middle term and factorise: $x^2 + 3x - 4 = (x - 1)(x + 4)$. 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 Q08.

Worked solutions • Chapter 4

HA4 - Algebraic manipulation • Questions 9-10

Q09 | 4 MARKS

Expansion gives $2x^2 + 2x - 12$. To reverse, split or identify the middle term and factorise: $2x^2 + 2x - 12 = (2x - 2)(x + 3)$. 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

Expansion gives $x^2 + x - 2$. To reverse, split or identify the middle term and factorise: $x^2 + x - 2 = (x - 1)(x + 2)$. 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 4

HA4 - Algebraic manipulation • Questions 11-12

Q11 | 5 MARKS

Expansion gives $2x^2 + 6x - 8$. To reverse, split or identify the middle term and factorise: $2x^2 + 6x - 8 = (2(x - 1))(x + 4)$. 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 Q11.

Q12 | 6 MARKS

Expansion gives $x^2 + 3x - 18$. To reverse, split or identify the middle term and factorise: $x^2 + 3x - 18 = (x - 3)(x + 6)$. 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 Q12.

Chapter 4 • Completion and retest record

HA4 - Algebraic manipulation

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 2 • CHAPTER 5****HA5 - Formulae and changing the subject****Chapter purpose**

Rearrange multi-stage formulae involving fractions, powers and roots.

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

HA5 - Formulae and changing the subject

Specification focus

Rearrange multi-stage formulae involving fractions, powers and roots.

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

HA5 - Formulae and changing the subject • Questions 1-2

Q01 | 4 MARKS

Make x the subject of $y = (3x-1)/(10x+5)$. State the value of y for which your rearranged denominator is zero. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Make x the subject of $y = (6x-4)/(5x+4)$. State the value of y for which your rearranged denominator is zero. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HA5 - Formulae and changing the subject • Questions 3-4

Q03 | 4 MARKS

Make x the subject of $y = (2x-2)/(8x+3)$. State the value of y for which your rearranged denominator is zero. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Make x the subject of $y = (5x-5)/(3x+2)$. State the value of y for which your rearranged denominator is zero. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HA5 - Formulae and changing the subject • Questions 5-6

Q05 | 4 MARKS

Make x the subject of $y = (8x - 3)/(6x + 5)$. State the value of y for which your rearranged denominator is zero. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Make x the subject of $y = (4x - 1)/(9x + 4)$. State the value of y for which your rearranged denominator is zero. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HA5 - Formulae and changing the subject • Questions 7-8

Q07 | 4 MARKS

Make x the subject of $y = (7x - 4)/(4x + 3)$. State the value of y for which your rearranged denominator is zero. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Make x the subject of $y = (3x - 2)/(7x + 2)$. State the value of y for which your rearranged denominator is zero. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HA5 - Formulae and changing the subject • Questions 9-10

Q09 | 4 MARKS

Make x the subject of $y = (6x - 5)/(10x + 5)$. State the value of y for which your rearranged denominator is zero. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

Make x the subject of $y = (2x - 3)/(5x + 4)$. State the value of y for which your rearranged denominator is zero. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HA5 - Formulae and changing the subject • Questions 11-12

Q11 | 5 MARKS

You must show your working. Make x the subject of $y = (3x-4)/(6x+5)$. State the value of y for which your rearranged denominator is zero. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. Make x the subject of $y = (4x-5)/(7x+2)$. State the value of y for which your rearranged denominator is zero. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 5

HA5 - Formulae and changing the subject • Questions 1-2

Q01 | 4 MARKS

$y(10x+5)=3x-1$; $10xy+5y=3x-1$; $x(10y-3)=-1-5y$. Hence $x=(1+5y)/(3-10y)$, requiring $y \neq 3/10$. 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 Q01.

Q02 | 4 MARKS

$y(5x+4)=6x-4$; $5xy+4y=6x-4$; $x(5y-6)=-4-4y$. Hence $x=(4+4y)/(6-5y)$, requiring $y \neq 6/5$. 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 Q02.

Worked solutions • Chapter 5

HA5 - Formulae and changing the subject • Questions 3-4

Q03 | 4 MARKS

$y(8x+3)=2x-2$; $8xy+3y=2x-2$; $x(8y-2)=-2-3y$. Hence $x=(2+3y)/(2-8y)$, requiring $y \neq 1/4$. 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 Q03.

Q04 | 4 MARKS

$y(3x+2)=5x-5$; $3xy+2y=5x-5$; $x(3y-5)=-5-2y$. Hence $x=(5+2y)/(5-3y)$, requiring $y \neq 5/3$. 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

HA5 - Formulae and changing the subject • Questions 5-6

Q05 | 4 MARKS

$y(6x+5)=8x-3$; $6xy+5y=8x-3$; $x(6y-8)=-3-5y$. Hence $x=(3+5y)/(8-6y)$, requiring $y \neq 4/3$. 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

$y(9x+4)=4x-1$; $9xy+4y=4x-1$; $x(9y-4)=-1-4y$. Hence $x=(1+4y)/(4-9y)$, requiring $y \neq 4/9$. 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 5

HA5 - Formulae and changing the subject • Questions 7-8

Q07 | 4 MARKS

$y(4x+3)=7x-4$; $4xy+3y=7x-4$; $x(4y-7)=-4-3y$. Hence $x=(4+3y)/(7-4y)$, requiring $y \neq 7/4$. 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 Q07.

Q08 | 4 MARKS

$y(7x+2)=3x-2$; $7xy+2y=3x-2$; $x(7y-3)=-2-2y$. Hence $x=(2+2y)/(3-7y)$, requiring $y \neq 3/7$. 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 Q08.

Worked solutions • Chapter 5

HA5 - Formulae and changing the subject • Questions 9-10

Q09 | 4 MARKS

$y(10x+5)=6x-5$; $10xy+5y=6x-5$; $x(10y-6)=-5-5y$. Hence $x=(5+5y)/(6-10y)$, requiring $y \neq 3/5$. 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 Q09.

Q10 | 4 MARKS

$y(5x+4)=2x-3$; $5xy+4y=2x-3$; $x(5y-2)=-3-4y$. Hence $x=(3+4y)/(2-5y)$, requiring $y \neq 2/5$. 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 Q10.

Worked solutions • Chapter 5

HA5 - Formulae and changing the subject • Questions 11-12

Q11 | 5 MARKS

$y(6x+5)=3x-4$; $6xy+5y=3x-4$; $x(6y-3)=-4-5y$. Hence $x=(4+5y)/(3-6y)$, requiring $y \neq 1/2$. 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

$y(7x+2)=4x-5$; $7xy+2y=4x-5$; $x(7y-4)=-5-2y$. Hence $x=(5+2y)/(4-7y)$, requiring $y \neq 4/7$. 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 Q12.

Chapter 5 • Completion and retest record

HA5 - Formulae and changing the subject

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 2 • CHAPTER 6****HA6 - Identities, arguments and proof****Chapter purpose**

Prove equivalence and construct algebraic parity and divisibility arguments.

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

HA6 - Identities, arguments and proof

Specification focus

Prove equivalence and construct algebraic parity and divisibility arguments.

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

HA6 - Identities, arguments and proof • Questions 1-2

Q01 | 4 MARKS

Prove algebraically that the difference between the squares of $9k+1$ and $9k-1$ is divisible by 36 for every integer k . Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Prove algebraically that the difference between the squares of $4k+1$ and $4k-1$ is divisible by 16 for every integer k . Your solution must justify the main method or assumption and include a final check.

Chapter 6 • Practice

HA6 - Identities, arguments and proof • Questions 3-4

Q03 | 4 MARKS

Prove algebraically that the difference between the squares of $7k+1$ and $7k-1$ is divisible by 28 for every integer k . Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Prove algebraically that the difference between the squares of $2k+1$ and $2k-1$ is divisible by 8 for every integer k . Your solution must justify the main method or assumption and include a final check.

Chapter 6 • Practice

HA6 - Identities, arguments and proof • Questions 5-6

Q05 | 4 MARKS

Prove algebraically that the difference between the squares of $5k+1$ and $5k-1$ is divisible by 20 for every integer k . Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Prove algebraically that the difference between the squares of $8k+1$ and $8k-1$ is divisible by 32 for every integer k . Your solution must justify the main method or assumption and include a final check.

Chapter 6 • Practice

HA6 - Identities, arguments and proof • Questions 7-8

Q07 | 4 MARKS

Prove algebraically that the difference between the squares of $3k+1$ and $3k-1$ is divisible by 12 for every integer k . Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Prove algebraically that the difference between the squares of $6k+1$ and $6k-1$ is divisible by 24 for every integer k . Your solution must justify the main method or assumption and include a final check.

Chapter 6 • Practice

HA6 - Identities, arguments and proof • Questions 9-10

Q09 | 4 MARKS

Prove algebraically that the difference between the squares of $9k+1$ and $9k-1$ is divisible by 36 for every integer k . 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

Prove algebraically that the difference between the squares of $4k+1$ and $4k-1$ is divisible by 16 for every integer k . 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

HA6 - Identities, arguments and proof • Questions 11-12

Q11 | 5 MARKS

You must show your working. Prove algebraically that the difference between the squares of $5k+1$ and $5k-1$ is divisible by 20 for every integer k . 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.

Q12 | 6 MARKS

You must show your working. Prove algebraically that the difference between the squares of $6k+1$ and $6k-1$ is divisible by 24 for every integer k . 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.

Worked solutions • Chapter 6

HA6 - Identities, arguments and proof • Questions 1-2

Q01 | 4 MARKS

Use difference of squares: $[(9k+1)^2-(9k-1)^2]=[(2)][2(9)k]=36k$. Since k is an integer, the result is divisible by 36. 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

Use difference of squares: $[(4k+1)^2-(4k-1)^2]=[(2)][2(4)k]=16k$. Since k is an integer, the result is divisible by 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 Q02.

Worked solutions • Chapter 6

HA6 - Identities, arguments and proof • Questions 3-4

Q03 | 4 MARKS

Use difference of squares: $[(7k+1)^2 - (7k-1)^2] = [(2)][2(7)k] = 28k$. Since k is an integer, the result is divisible by 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 Q03.

Q04 | 4 MARKS

Use difference of squares: $[(2k+1)^2 - (2k-1)^2] = [(2)][2(2)k] = 8k$. Since k is an integer, the result is divisible by 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 Q04.

Worked solutions • Chapter 6

HA6 - Identities, arguments and proof • Questions 5–6

Q05 | 4 MARKS

Use difference of squares: $[(5k+1)^2 - (5k-1)^2] = [(2)][2(5)k] = 20k$. Since k is an integer, the result is divisible by 20. 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

Use difference of squares: $[(8k+1)^2 - (8k-1)^2] = [(2)][2(8)k] = 32k$. Since k is an integer, the result is divisible by 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 Q06.

Worked solutions • Chapter 6

HA6 - Identities, arguments and proof • Questions 7–8

Q07 | 4 MARKS

Use difference of squares: $[(3k+1)^2 - (3k-1)^2] = [(2)][2(3)k] = 12k$. Since k is an integer, the result is divisible by 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 Q07.

Q08 | 4 MARKS

Use difference of squares: $[(6k+1)^2 - (6k-1)^2] = [(2)][2(6)k] = 24k$. Since k is an integer, the result is divisible by 24. 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 6

HA6 - Identities, arguments and proof • Questions 9–10

Q09 | 4 MARKS

Use difference of squares: $[(9k+1)^2 - (9k-1)^2] = [(2)][2(9)k] = 36k$. Since k is an integer, the result is divisible by 36. 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

Use difference of squares: $[(4k+1)^2 - (4k-1)^2] = [(2)][2(4)k] = 16k$. Since k is an integer, the result is divisible by 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 Q10.

Worked solutions • Chapter 6

HA6 - Identities, arguments and proof • Questions 11-12

Q11 | 5 MARKS

Use difference of squares: $[(5k+1)^2 - (5k-1)^2] = [(2)][2(5)k] = 20k$. Since k is an integer, the result is divisible by 20. 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 Q11.

Q12 | 6 MARKS

Use difference of squares: $[(6k+1)^2 - (6k-1)^2] = [(2)][2(6)k] = 24k$. Since k is an integer, the result is divisible by 24. 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 Q12.

Chapter 6 • Completion and retest record

HA6 - Identities, arguments and proof

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 2 • CHAPTER 7****HA7 - Functions, inverses and composites****Chapter purpose**

Use function notation, composite functions, inverse functions and appropriate domains.

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

HA7 - Functions, inverses and composites

Specification focus

Use function notation, composite functions, inverse functions and appropriate domains.

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

HA7 - Functions, inverses and composites • Questions 1-2

Q01 | 4 MARKS

Let $f(x)=3x+1$ and $g(x)=x^2-10$. Find $f(g(x))$, $g(f(x))$ and $f^{-1}(x)$, stating why the two compositions differ. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Let $f(x)=6x+4$ and $g(x)=x^2-5$. Find $f(g(x))$, $g(f(x))$ and $f^{-1}(x)$, stating why the two compositions differ. Your solution must justify the main method or assumption and include a final check.

Chapter 7 • Practice

HA7 - Functions, inverses and composites • Questions 3-4

Q03 | 4 MARKS

Let $f(x)=2x+2$ and $g(x)=x^2-8$. Find $f(g(x))$, $g(f(x))$ and $f^{-1}(x)$, stating why the two compositions differ. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Let $f(x)=5x+5$ and $g(x)=x^2-3$. Find $f(g(x))$, $g(f(x))$ and $f^{-1}(x)$, stating why the two compositions differ. Your solution must justify the main method or assumption and include a final check.

Chapter 7 • Practice

HA7 - Functions, inverses and composites • Questions 5-6

Q05 | 4 MARKS

Let $f(x)=8x+3$ and $g(x)=x^2-6$. Find $f(g(x))$, $g(f(x))$ and $f^{-1}(x)$, stating why the two compositions differ. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Let $f(x)=4x+1$ and $g(x)=x^2-9$. Find $f(g(x))$, $g(f(x))$ and $f^{-1}(x)$, stating why the two compositions differ. Your solution must justify the main method or assumption and include a final check.

Chapter 7 • Practice

HA7 - Functions, inverses and composites • Questions 7-8

Q07 | 4 MARKS

Let $f(x)=7x+4$ and $g(x)=x^2-4$. Find $f(g(x))$, $g(f(x))$ and $f^{-1}(x)$, stating why the two compositions differ. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Let $f(x)=3x+2$ and $g(x)=x^2-7$. Find $f(g(x))$, $g(f(x))$ and $f^{-1}(x)$, stating why the two compositions differ. Your solution must justify the main method or assumption and include a final check.

Chapter 7 • Practice

HA7 - Functions, inverses and composites • Questions 9-10

Q09 | 4 MARKS

Let $f(x)=6x+5$ and $g(x)=x^2-10$. Find $f(g(x))$, $g(f(x))$ and $f^{-1}(x)$, stating why the two compositions differ. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

Let $f(x)=2x+3$ and $g(x)=x^2-5$. Find $f(g(x))$, $g(f(x))$ and $f^{-1}(x)$, stating why the two compositions differ. Your solution must justify the main method or assumption and include a final check.

Chapter 7 • Practice

HA7 - Functions, inverses and composites • Questions 11-12

Q11 | 5 MARKS

You must show your working. Let $f(x)=3x+4$ and $g(x)=x^2-6$. Find $f(g(x))$, $g(f(x))$ and $f^{-1}(x)$, stating why the two compositions differ. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. Let $f(x)=4x+5$ and $g(x)=x^2-7$. Find $f(g(x))$, $g(f(x))$ and $f^{-1}(x)$, stating why the two compositions differ. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 7

HA7 - Functions, inverses and composites • Questions 1-2

Q01 | 4 MARKS

$f(g(x)) = 3(x^2 - 10) + 1 = 3x^2 - 29$. $g(f(x)) = (3x + 1)^2 - 10 = 9x^2 + 6x - 9$. From $y = 3x + 1$, $f^{-1}(x) = (x - 1)/3$. Composition order changes the operations. 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

$f(g(x)) = 6(x^2 - 5) + 4 = 6x^2 - 26$. $g(f(x)) = (6x + 4)^2 - 5 = 36x^2 + 48x + 11$. From $y = 6x + 4$, $f^{-1}(x) = (x - 4)/6$. Composition order changes the operations. 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

HA7 - Functions, inverses and composites • Questions 3-4

Q03 | 4 MARKS

$f(g(x)) = 2(x^2 - 8) + 2 = 2x^2 - 14$. $g(f(x)) = (2x + 2)^2 - 8 = 4x^2 + 8x - 4$. From $y = 2x + 2$, $f^{-1}(-1)(x) = (x - 2)/2$. Composition order changes the operations. 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

$f(g(x)) = 5(x^2 - 3) + 5 = 5x^2 - 10$. $g(f(x)) = (5x + 5)^2 - 3 = 25x^2 + 50x + 22$. From $y = 5x + 5$, $f^{-1}(-1)(x) = (x - 5)/5$. Composition order changes the operations. 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

HA7 - Functions, inverses and composites • Questions 5-6

Q05 | 4 MARKS

$f(g(x)) = 8(x^2 - 6) + 3 = 8x^2 - 45$. $g(f(x)) = (8x + 3)^2 - 6 = 64x^2 + 48x + 3$. From $y = 8x + 3$, $f^{-1}(x) = (x - 3)/8$. Composition order changes the operations. 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

$f(g(x)) = 4(x^2 - 9) + 1 = 4x^2 - 35$. $g(f(x)) = (4x + 1)^2 - 9 = 16x^2 + 8x - 8$. From $y = 4x + 1$, $f^{-1}(x) = (x - 1)/4$. Composition order changes the operations. 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

HA7 - Functions, inverses and composites • Questions 7-8

Q07 | 4 MARKS

$f(g(x)) = 7(x^2 - 4) + 4 = 7x^2 - 24$. $g(f(x)) = (7x + 4)^2 - 4 = 49x^2 + 56x + 12$. From $y = 7x + 4$, $f^{-1}(-1)(x) = (x - 4)/7$. Composition order changes the operations. 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

$f(g(x)) = 3(x^2 - 7) + 2 = 3x^2 - 19$. $g(f(x)) = (3x + 2)^2 - 7 = 9x^2 + 12x - 3$. From $y = 3x + 2$, $f^{-1}(-1)(x) = (x - 2)/3$. Composition order changes the operations. 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

HA7 - Functions, inverses and composites • Questions 9-10

Q09 | 4 MARKS

$f(g(x)) = 6(x^2 - 10) + 5 = 6x^2 - 55$. $g(f(x)) = (6x + 5)^2 - 10 = 36x^2 + 60x + 15$. From $y = 6x + 5$, $f^{-1}(x) = (x - 5)/6$. Composition order changes the operations. 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

$f(g(x)) = 2(x^2 - 5) + 3 = 2x^2 - 7$. $g(f(x)) = (2x + 3)^2 - 5 = 4x^2 + 12x + 4$. From $y = 2x + 3$, $f^{-1}(x) = (x - 3)/2$. Composition order changes the operations. 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

HA7 - Functions, inverses and composites • Questions 11-12

Q11 | 5 MARKS

$f(g(x)) = 3(x^2 - 6) + 4 = 3x^2 - 14$. $g(f(x)) = (3x + 4)^2 - 6 = 9x^2 + 24x + 10$. From $y = 3x + 4$, $f^{-1}(x) = (x - 4)/3$. Composition order changes the operations. 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

$f(g(x)) = 4(x^2 - 7) + 5 = 4x^2 - 23$. $g(f(x)) = (4x + 5)^2 - 7 = 16x^2 + 40x + 18$. From $y = 4x + 5$, $f^{-1}(x) = (x - 5)/4$. Composition order changes the operations. 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

HA7 - Functions, inverses and composites

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 2 • CHAPTER 8****HA8 - Coordinates****Chapter purpose**

Work accurately with points and geometric-algebraic information in all four quadrants.

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

HA8 - Coordinates

Specification focus

Work accurately with points and geometric-algebraic information in all four quadrants.

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

HA8 - Coordinates • Questions 1-2

Q01 | 4 MARKS

A line has gradient 1 and passes through (2,3). Find its equation. Then find the equation of the perpendicular line through the same point. State the coordinates used at every decisive stage. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A line has gradient 4 and passes through (-4,6). Find its equation. Then find the equation of the perpendicular line through the same point. State the coordinates used at every decisive stage. Your solution must justify the main method or assumption and include a final check.

Chapter 8 • Practice

HA8 - Coordinates • Questions 3-4

Q03 | 4 MARKS

A line has gradient 2 and passes through $(-1,2)$. Find its equation. Then find the equation of the perpendicular line through the same point. State the coordinates used at every decisive stage. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A line has gradient 5 and passes through $(2,5)$. Find its equation. Then find the equation of the perpendicular line through the same point. State the coordinates used at every decisive stage. Your solution must justify the main method or assumption and include a final check.

Chapter 8 • Practice

HA8 - Coordinates • Questions 5-6

Q05 | 4 MARKS

A line has gradient 3 and passes through $(-4, 8)$. Find its equation. Then find the equation of the perpendicular line through the same point. State the coordinates used at every decisive stage. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A line has gradient 1 and passes through $(-1, 4)$. Find its equation. Then find the equation of the perpendicular line through the same point. State the coordinates used at every decisive stage. Your solution must justify the main method or assumption and include a final check.

Chapter 8 • Practice

HA8 - Coordinates • Questions 7-8

Q07 | 4 MARKS

A line has gradient 4 and passes through (2,7). Find its equation. Then find the equation of the perpendicular line through the same point. State the coordinates used at every decisive stage. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A line has gradient 2 and passes through (-4,3). Find its equation. Then find the equation of the perpendicular line through the same point. State the coordinates used at every decisive stage. Your solution must justify the main method or assumption and include a final check.

Chapter 8 • Practice

HA8 - Coordinates • Questions 9-10

Q09 | 4 MARKS

A line has gradient 5 and passes through $(-1,6)$. Find its equation. Then find the equation of the perpendicular line through the same point. State the coordinates used at every decisive stage. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

A line has gradient 3 and passes through $(2,2)$. Find its equation. Then find the equation of the perpendicular line through the same point. State the coordinates used at every decisive stage. Your solution must justify the main method or assumption and include a final check.

Chapter 8 • Practice

HA8 - Coordinates • Questions 11-12

Q11 | 5 MARKS

You must show your working. A line has gradient 4 and passes through (3,3). Find its equation. Then find the equation of the perpendicular line through the same point. State the coordinates used at every decisive stage. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A line has gradient 5 and passes through (4,4). Find its equation. Then find the equation of the perpendicular line through the same point. State the coordinates used at every decisive stage. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 8

HA8 - Coordinates • Questions 1-2

Q01 | 4 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=x+1$. A perpendicular gradient is $-1/1$; its intercept is 5, so $y=-x+5$. Coordinate evidence must be visible in the reasoning. 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

Using $y-y_1=m(x-x_1)$, the first line is $y=4x+22$. A perpendicular gradient is $-1/4$; its intercept is 5, so $y=-1/4x+5$. Coordinate evidence must be visible in the reasoning. 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

HA8 - Coordinates • Questions 3-4

Q03 | 4 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=2x+4$. A perpendicular gradient is $-1/2$; its intercept is $3/2$, so $y=-1/2x+3/2$. Coordinate evidence must be visible in the reasoning. 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

Using $y-y_1=m(x-x_1)$, the first line is $y=5x-5$. A perpendicular gradient is $-1/5$; its intercept is $27/5$, so $y=-1/5x+27/5$. Coordinate evidence must be visible in the reasoning. 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

HA8 - Coordinates • Questions 5-6

Q05 | 4 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=3x+20$. A perpendicular gradient is $-1/3$; its intercept is $20/3$, so $y=-1/3x+20/3$. Coordinate evidence must be visible in the reasoning. 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

Using $y-y_1=m(x-x_1)$, the first line is $y=x+5$. A perpendicular gradient is $-1/1$; its intercept is 3, so $y=-x+3$. Coordinate evidence must be visible in the reasoning. 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

HA8 - Coordinates • Questions 7-8

Q07 | 4 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=4x-1$. A perpendicular gradient is $-1/4$; its intercept is $15/2$, so $y=-1/4x+15/2$. Coordinate evidence must be visible in the reasoning. 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

Using $y-y_1=m(x-x_1)$, the first line is $y=2x+11$. A perpendicular gradient is $-1/2$; its intercept is 1 , so $y=-1/2x+1$. Coordinate evidence must be visible in the reasoning. 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

HA8 - Coordinates • Questions 9-10

Q09 | 4 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=5x+11$. A perpendicular gradient is $-1/5$; its intercept is $29/5$, so $y=-1/5x+29/5$. Coordinate evidence must be visible in the reasoning. 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

Using $y-y_1=m(x-x_1)$, the first line is $y=3x-4$. A perpendicular gradient is $-1/3$; its intercept is $8/3$, so $y=-1/3x+8/3$. Coordinate evidence must be visible in the reasoning. 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

HA8 - Coordinates • Questions 11-12

Q11 | 5 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=4x-9$. A perpendicular gradient is $-1/4$; its intercept is $15/4$, so $y=-1/4x+15/4$. Coordinate evidence must be visible in the reasoning. 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

Using $y-y_1=m(x-x_1)$, the first line is $y=5x-16$. A perpendicular gradient is $-1/5$; its intercept is $24/5$, so $y=-1/5x+24/5$. Coordinate evidence must be visible in the reasoning. 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

HA8 - Coordinates

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 2 • CHAPTER 9****HA9 - Straight-line graphs****Chapter purpose**

Plot and derive line equations; identify parallel and perpendicular relationships.

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

HA9 - Straight-line graphs

Specification focus

Plot and derive line equations; identify parallel and perpendicular relationships.

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

HA9 - Straight-line graphs • Questions 1-2

Q01 | 4 MARKS

A line has gradient 1 and passes through (2,3). Find its equation. Then find the equation of the perpendicular line through the same point. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A line has gradient 4 and passes through (-4,6). Find its equation. Then find the equation of the perpendicular line through the same point. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HA9 - Straight-line graphs • Questions 3-4

Q03 | 4 MARKS

A line has gradient 2 and passes through $(-1,2)$. Find its equation. Then find the equation of the perpendicular line through the same point. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A line has gradient 5 and passes through $(2,5)$. Find its equation. Then find the equation of the perpendicular line through the same point. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HA9 - Straight-line graphs • Questions 5-6

Q05 | 4 MARKS

A line has gradient 3 and passes through $(-4, 8)$. Find its equation. Then find the equation of the perpendicular line through the same point. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A line has gradient 1 and passes through $(-1, 4)$. Find its equation. Then find the equation of the perpendicular line through the same point. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HA9 - Straight-line graphs • Questions 7-8

Q07 | 4 MARKS

A line has gradient 4 and passes through (2,7). Find its equation. Then find the equation of the perpendicular line through the same point. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A line has gradient 2 and passes through (-4,3). Find its equation. Then find the equation of the perpendicular line through the same point. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HA9 - Straight-line graphs • Questions 9-10

Q09 | 4 MARKS

A line has gradient 5 and passes through $(-1,6)$. Find its equation. Then find the equation of the perpendicular line through the same point. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

A line has gradient 3 and passes through $(2,2)$. Find its equation. Then find the equation of the perpendicular line through the same point. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HA9 - Straight-line graphs • Questions 11-12

Q11 | 5 MARKS

You must show your working. A line has gradient 4 and passes through (3,3). Find its equation. Then find the equation of the perpendicular line through the same point. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A line has gradient 5 and passes through (4,4). Find its equation. Then find the equation of the perpendicular line through the same point. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 9

HA9 - Straight-line graphs • Questions 1-2

Q01 | 4 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=x+1$. A perpendicular gradient is $-1/1$; its intercept is 5, so $y=-x+5$. 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

Using $y-y_1=m(x-x_1)$, the first line is $y=4x+22$. A perpendicular gradient is $-1/4$; its intercept is 5, so $y=-1/4x+5$. 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 Q02.

Worked solutions • Chapter 9

HA9 - Straight-line graphs • Questions 3–4

Q03 | 4 MARKS

Using $y - y_1 = m(x - x_1)$, the first line is $y = 2x + 4$. A perpendicular gradient is $-1/2$; its intercept is $3/2$, so $y = -1/2x + 3/2$. 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

Using $y - y_1 = m(x - x_1)$, the first line is $y = 5x - 5$. A perpendicular gradient is $-1/5$; its intercept is $27/5$, so $y = -1/5x + 27/5$. 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 Q04.

Worked solutions • Chapter 9

HA9 - Straight-line graphs • Questions 5–6

Q05 | 4 MARKS

Using $y - y_1 = m(x - x_1)$, the first line is $y = 3x + 20$. A perpendicular gradient is $-1/3$; its intercept is $20/3$, so $y = -1/3x + 20/3$. 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

Using $y - y_1 = m(x - x_1)$, the first line is $y = x + 5$. A perpendicular gradient is $-1/1$; its intercept is 3, so $y = -x + 3$. 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

HA9 - Straight-line graphs • Questions 7-8

Q07 | 4 MARKS

Using $y - y_1 = m(x - x_1)$, the first line is $y = 4x - 1$. A perpendicular gradient is $-1/4$; its intercept is $15/2$, so $y = -1/4x + 15/2$. 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

Using $y - y_1 = m(x - x_1)$, the first line is $y = 2x + 11$. A perpendicular gradient is $-1/2$; its intercept is 1, so $y = -1/2x + 1$. 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 9

HA9 - Straight-line graphs • Questions 9-10

Q09 | 4 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=5x+11$. A perpendicular gradient is $-1/5$; its intercept is $29/5$, so $y=-1/5x+29/5$. 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 Q09.

Q10 | 4 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=3x-4$. A perpendicular gradient is $-1/3$; its intercept is $8/3$, so $y=-1/3x+8/3$. 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

HA9 - Straight-line graphs • Questions 11-12

Q11 | 5 MARKS

Using $y - y_1 = m(x - x_1)$, the first line is $y = 4x - 9$. A perpendicular gradient is $-1/4$; its intercept is $15/4$, so $y = -1/4x + 15/4$. 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 Q11.

Q12 | 6 MARKS

Using $y - y_1 = m(x - x_1)$, the first line is $y = 5x - 16$. A perpendicular gradient is $-1/5$; its intercept is $24/5$, so $y = -1/5x + 24/5$. 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 Q12.

Chapter 9 • Completion and retest record

HA9 - Straight-line graphs

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 2 • CHAPTER 10****HA10 - Gradients and intercepts****Chapter purpose**

Interpret gradients and intercepts graphically, algebraically and contextually.

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

HA10 - Gradients and intercepts

Specification focus

Interpret gradients and intercepts graphically, algebraically and contextually.

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

HA10 - Gradients and intercepts • Questions 1-2

Q01 | 4 MARKS

A line has gradient 1 and passes through (2,3). Find its equation. Then find the equation of the perpendicular line through the same point. Interpret the sign and units of the gradient or intercept where a context is present. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A line has gradient 4 and passes through (-4,6). Find its equation. Then find the equation of the perpendicular line through the same point. Interpret the sign and units of the gradient or intercept where a context is present. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HA10 - Gradients and intercepts • Questions 3-4

Q03 | 4 MARKS

A line has gradient 2 and passes through $(-1,2)$. Find its equation. Then find the equation of the perpendicular line through the same point. Interpret the sign and units of the gradient or intercept where a context is present. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A line has gradient 5 and passes through $(2,5)$. Find its equation. Then find the equation of the perpendicular line through the same point. Interpret the sign and units of the gradient or intercept where a context is present. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HA10 - Gradients and intercepts • Questions 5-6

Q05 | 4 MARKS

A line has gradient 3 and passes through $(-4, 8)$. Find its equation. Then find the equation of the perpendicular line through the same point. Interpret the sign and units of the gradient or intercept where a context is present. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A line has gradient 1 and passes through $(-1, 4)$. Find its equation. Then find the equation of the perpendicular line through the same point. Interpret the sign and units of the gradient or intercept where a context is present. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HA10 - Gradients and intercepts • Questions 7-8

Q07 | 4 MARKS

A line has gradient 4 and passes through (2,7). Find its equation. Then find the equation of the perpendicular line through the same point. Interpret the sign and units of the gradient or intercept where a context is present. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A line has gradient 2 and passes through (-4,3). Find its equation. Then find the equation of the perpendicular line through the same point. Interpret the sign and units of the gradient or intercept where a context is present. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HA10 - Gradients and intercepts • Questions 9-10

Q09 | 4 MARKS

A line has gradient 5 and passes through $(-1,6)$. Find its equation. Then find the equation of the perpendicular line through the same point. Interpret the sign and units of the gradient or intercept where a context is present. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

A line has gradient 3 and passes through $(2,2)$. Find its equation. Then find the equation of the perpendicular line through the same point. Interpret the sign and units of the gradient or intercept where a context is present. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HA10 - Gradients and intercepts • Questions 11-12

Q11 | 5 MARKS

You must show your working. A line has gradient 4 and passes through (3,3). Find its equation. Then find the equation of the perpendicular line through the same point. Interpret the sign and units of the gradient or intercept where a context is present. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A line has gradient 5 and passes through (4,4). Find its equation. Then find the equation of the perpendicular line through the same point. Interpret the sign and units of the gradient or intercept where a context is present. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 10

HA10 - Gradients and intercepts • Questions 1-2

Q01 | 4 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=x+1$. A perpendicular gradient is $-1/1$; its intercept is 5, so $y=-x+5$. The interpretation should link the algebraic parameter to the graph or context. 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

Using $y-y_1=m(x-x_1)$, the first line is $y=4x+22$. A perpendicular gradient is $-1/4$; its intercept is 5, so $y=-1/4x+5$. The interpretation should link the algebraic parameter to the graph or context. 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

HA10 - Gradients and intercepts • Questions 3-4

Q03 | 4 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=2x+4$. A perpendicular gradient is $-1/2$; its intercept is $3/2$, so $y=-1/2x+3/2$. The interpretation should link the algebraic parameter to the graph or context. 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

Using $y-y_1=m(x-x_1)$, the first line is $y=5x-5$. A perpendicular gradient is $-1/5$; its intercept is $27/5$, so $y=-1/5x+27/5$. The interpretation should link the algebraic parameter to the graph or context. 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

HA10 - Gradients and intercepts • Questions 5-6

Q05 | 4 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=3x+20$. A perpendicular gradient is $-1/3$; its intercept is $20/3$, so $y=-1/3x+20/3$. The interpretation should link the algebraic parameter to the graph or context. 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

Using $y-y_1=m(x-x_1)$, the first line is $y=x+5$. A perpendicular gradient is $-1/1$; its intercept is 3, so $y=-x+3$. The interpretation should link the algebraic parameter to the graph or context. 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

HA10 - Gradients and intercepts • Questions 7-8

Q07 | 4 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=4x-1$. A perpendicular gradient is $-1/4$; its intercept is $15/2$, so $y=-1/4x+15/2$. The interpretation should link the algebraic parameter to the graph or context. 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

Using $y-y_1=m(x-x_1)$, the first line is $y=2x+11$. A perpendicular gradient is $-1/2$; its intercept is 1 , so $y=-1/2x+1$. The interpretation should link the algebraic parameter to the graph or context. 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

HA10 - Gradients and intercepts • Questions 9-10

Q09 | 4 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=5x+11$. A perpendicular gradient is $-1/5$; its intercept is $29/5$, so $y=-1/5x+29/5$. The interpretation should link the algebraic parameter to the graph or context. 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

Using $y-y_1=m(x-x_1)$, the first line is $y=3x-4$. A perpendicular gradient is $-1/3$; its intercept is $8/3$, so $y=-1/3x+8/3$. The interpretation should link the algebraic parameter to the graph or context. 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

HA10 - Gradients and intercepts • Questions 11-12

Q11 | 5 MARKS

Using $y-y_1=m(x-x_1)$, the first line is $y=4x-9$. A perpendicular gradient is $-1/4$; its intercept is $15/4$, so $y=-1/4x+15/4$. The interpretation should link the algebraic parameter to the graph or context. 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

Using $y-y_1=m(x-x_1)$, the first line is $y=5x-16$. A perpendicular gradient is $-1/5$; its intercept is $24/5$, so $y=-1/5x+24/5$. The interpretation should link the algebraic parameter to the graph or context. 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

HA10 - Gradients and intercepts

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 2 • CHAPTER 11****HA11 - Quadratic roots and turning points****Chapter purpose**

Connect intercepts, roots, completing the square and stationary points.

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

HA11 - Quadratic roots and turning points

Specification focus

Connect intercepts, roots, completing the square and stationary points.

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

HA11 - Quadratic roots and turning points • Questions 1-2

Q01 | 4 MARKS

For $y = x^2 + 4x - 5$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

For $y = x^2 - 2x - 8$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Your solution must justify the main method or assumption and include a final check.

Chapter 11 • Practice

HA11 - Quadratic roots and turning points • Questions 3-4

Q03 | 4 MARKS

For $y = x^2 + 3x - 10$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Your solution must justify the main method or assumption and include a final check.

Q04 | 5 MARKS

For $y = x^2 - 3x - 10$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Your solution must justify the main method or assumption and include a final check. Verify the result using an independent inverse operation or a second representation.

Chapter 11 • Practice

HA11 - Quadratic roots and turning points • Questions 5-6

Q05 | 4 MARKS

For $y = x^2 + 2x - 15$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

For $y = x^2 + x - 2$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Your solution must justify the main method or assumption and include a final check.

Chapter 11 • Practice

HA11 - Quadratic roots and turning points • Questions 7-8

Q07 | 4 MARKS

For $y = x^2 + x - 20$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

For $y = x^2 - 4$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Your solution must justify the main method or assumption and include a final check.

Chapter 11 • Practice

HA11 - Quadratic roots and turning points • Questions 9-10

Q09 | 4 MARKS

For $y = x^2 - 25$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

For $y = x^2 - x - 6$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Your solution must justify the main method or assumption and include a final check.

Chapter 11 • Practice

HA11 - Quadratic roots and turning points • Questions 11-12

Q11 | 5 MARKS

You must show your working. For $y = x^2 - x - 12$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. For $y = x^2 - x - 20$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 11

HA11 - Quadratic roots and turning points • Questions 1-2

Q01 | 4 MARKS

Factor form gives roots $x=1$, $x=-5$. The y-intercept is -5 . The axis is the midpoint, $x=-2$. The discriminant is $36>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. 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

Factor form gives roots $x=4$, $x=-2$. The y-intercept is -8 . The axis is the midpoint, $x=1$. The discriminant is $36>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. 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

HA11 - Quadratic roots and turning points • Questions 3-4

Q03 | 4 MARKS

Factor form gives roots $x=2$, $x=-5$. The y-intercept is -10 . The axis is the midpoint, $x=-3/2$. The discriminant is $49>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. 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 | 5 MARKS

Factor form gives roots $x=5$, $x=-2$. The y-intercept is -10 . The axis is the midpoint, $x=3/2$. The discriminant is $49>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. 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 11

HA11 - Quadratic roots and turning points • Questions 5-6

Q05 | 4 MARKS

Factor form gives roots $x=3$, $x=-5$. The y-intercept is -15 . The axis is the midpoint, $x=-1$. The discriminant is $64>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. 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

Factor form gives roots $x=1$, $x=-2$. The y-intercept is -2 . The axis is the midpoint, $x=-1/2$. The discriminant is $9>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. 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

HA11 - Quadratic roots and turning points • Questions 7-8

Q07 | 4 MARKS

Factor form gives roots $x=4$, $x=-5$. The y-intercept is -20 . The axis is the midpoint, $x=-1/2$. The discriminant is $81>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. 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

Factor form gives roots $x=2$, $x=-2$. The y-intercept is -4 . The axis is the midpoint, $x=0$. The discriminant is $16>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. 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

HA11 - Quadratic roots and turning points • Questions 9-10

Q09 | 4 MARKS

Factor form gives roots $x=5$, $x=-5$. The y-intercept is -25 . The axis is the midpoint, $x=0$. The discriminant is $100>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. 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

Factor form gives roots $x=3$, $x=-2$. The y-intercept is -6 . The axis is the midpoint, $x=1/2$. The discriminant is $25>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. 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

HA11 - Quadratic roots and turning points • Questions 11-12

Q11 | 5 MARKS

Factor form gives roots $x=4$, $x=-3$. The y-intercept is -12 . The axis is the midpoint, $x=1/2$. The discriminant is $49>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. 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

Factor form gives roots $x=5$, $x=-4$. The y-intercept is -20 . The axis is the midpoint, $x=1/2$. The discriminant is $81>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. 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

HA11 - Quadratic roots and turning points

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 2 • CHAPTER 12****HA12 - Recognising function graphs****Chapter purpose**

Sketch and interpret linear, quadratic, cubic, reciprocal, exponential and trigonometric graphs.

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

HA12 - Recognising function graphs

Specification focus

Sketch and interpret linear, quadratic, cubic, reciprocal, exponential and trigonometric graphs.

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

HA12 - Recognising function graphs • Questions 1-2

Q01 | 4 MARKS

For $y = x^2 + 4x - 5$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Identify the graph family and justify its characteristic shape before solving. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

For $y = x^2 - 2x - 8$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Identify the graph family and justify its characteristic shape before solving. Your solution must justify the main method or assumption and include a final check.

Chapter 12 • Practice

HA12 - Recognising function graphs • Questions 3-4

Q03 | 4 MARKS

For $y = x^2 + 3x - 10$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Identify the graph family and justify its characteristic shape before solving. Your solution must justify the main method or assumption and include a final check.

Q04 | 5 MARKS

For $y = x^2 - 3x - 10$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Identify the graph family and justify its characteristic shape before solving. Your solution must justify the main method or assumption and include a final check. Verify the result using an independent inverse operation or a second representation.

Chapter 12 • Practice

HA12 - Recognising function graphs • Questions 5-6

Q05 | 4 MARKS

For $y = x^2 + 2x - 15$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Identify the graph family and justify its characteristic shape before solving. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

For $y = x^2 + x - 2$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Identify the graph family and justify its characteristic shape before solving. Your solution must justify the main method or assumption and include a final check.

Chapter 12 • Practice

HA12 - Recognising function graphs • Questions 7-8

Q07 | 4 MARKS

For $y = x^2 + x - 20$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Identify the graph family and justify its characteristic shape before solving. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

For $y = x^2 - 4$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Identify the graph family and justify its characteristic shape before solving. Your solution must justify the main method or assumption and include a final check.

Chapter 12 • Practice

HA12 - Recognising function graphs • Questions 9-10

Q09 | 4 MARKS

For $y = x^2 - 25$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Identify the graph family and justify its characteristic shape before solving. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

For $y = x^2 - x - 6$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Identify the graph family and justify its characteristic shape before solving. Your solution must justify the main method or assumption and include a final check.

Chapter 12 • Practice

HA12 - Recognising function graphs • Questions 11-12

Q11 | 5 MARKS

You must show your working. For $y = x^2 - x - 12$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Identify the graph family and justify its characteristic shape before solving. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. For $y = x^2 - x - 20$, find the roots, y-intercept, axis of symmetry and discriminant. Use them to describe the graph. Identify the graph family and justify its characteristic shape before solving. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 12

HA12 - Recognising function graphs • Questions 1-2

Q01 | 4 MARKS

Factor form gives roots $x=1$, $x=-5$. The y-intercept is -5 . The axis is the midpoint, $x=-2$. The discriminant is $36>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. Credit a correct family identification supported by its intercept, asymptote, symmetry or periodicity. 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

Factor form gives roots $x=4$, $x=-2$. The y-intercept is -8 . The axis is the midpoint, $x=1$. The discriminant is $36>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. Credit a correct family identification supported by its intercept, asymptote, symmetry or periodicity. 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

HA12 - Recognising function graphs • Questions 3-4

Q03 | 4 MARKS

Factor form gives roots $x=2$, $x=-5$. The y-intercept is -10 . The axis is the midpoint, $x=-3/2$. The discriminant is $49>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. Credit a correct family identification supported by its intercept, asymptote, symmetry or periodicity. 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 | 5 MARKS

Factor form gives roots $x=5$, $x=-2$. The y-intercept is -10 . The axis is the midpoint, $x=3/2$. The discriminant is $49>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. Credit a correct family identification supported by its intercept, asymptote, symmetry or periodicity. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context. 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 12

HA12 - Recognising function graphs • Questions 5-6

Q05 | 4 MARKS

Factor form gives roots $x=3$, $x=-5$. The y-intercept is -15 . The axis is the midpoint, $x=-1$. The discriminant is $64>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. Credit a correct family identification supported by its intercept, asymptote, symmetry or periodicity. 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

Factor form gives roots $x=1$, $x=-2$. The y-intercept is -2 . The axis is the midpoint, $x=-1/2$. The discriminant is $9>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. Credit a correct family identification supported by its intercept, asymptote, symmetry or periodicity. 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 12

HA12 - Recognising function graphs • Questions 7-8

Q07 | 4 MARKS

Factor form gives roots $x=4$, $x=-5$. The y-intercept is -20 . The axis is the midpoint, $x=-1/2$. The discriminant is $81>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. Credit a correct family identification supported by its intercept, asymptote, symmetry or periodicity. 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

Factor form gives roots $x=2$, $x=-2$. The y-intercept is -4 . The axis is the midpoint, $x=0$. The discriminant is $16>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. Credit a correct family identification supported by its intercept, asymptote, symmetry or periodicity. 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 12

HA12 - Recognising function graphs • Questions 9-10

Q09 | 4 MARKS

Factor form gives roots $x=5$, $x=-5$. The y-intercept is -25 . The axis is the midpoint, $x=0$. The discriminant is $100>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. Credit a correct family identification supported by its intercept, asymptote, symmetry or periodicity. 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

Factor form gives roots $x=3$, $x=-2$. The y-intercept is -6 . The axis is the midpoint, $x=1/2$. The discriminant is $25>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. Credit a correct family identification supported by its intercept, asymptote, symmetry or periodicity. 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 12

HA12 - Recognising function graphs • Questions 11-12

Q11 | 5 MARKS

Factor form gives roots $x=4$, $x=-3$. The y-intercept is -12 . The axis is the midpoint, $x=1/2$. The discriminant is $49>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. Credit a correct family identification supported by its intercept, asymptote, symmetry or periodicity. 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

Factor form gives roots $x=5$, $x=-4$. The y-intercept is -20 . The axis is the midpoint, $x=1/2$. The discriminant is $81>0$, confirming two distinct real roots; the positive x^2 coefficient means the graph opens upward. Credit a correct family identification supported by its intercept, asymptote, symmetry or periodicity. 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

HA12 - Recognising function graphs

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 2 • CHAPTER 13****HA13 - Graph transformations****Chapter purpose**

Apply and describe translations and reflections of functions.

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

HA13 - Graph transformations

Specification focus

Apply and describe translations and reflections of functions.

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

HA13 - Graph transformations • Questions 1-2

Q01 | 4 MARKS

The graph $y=f(x)$ is transformed to $y=3f(x+2)+1$. Describe the transformations in a valid order and map the point (2,5). Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

The graph $y=f(x)$ is transformed to $y=6f(x-1)-2$. Describe the transformations in a valid order and map the point (2,5). Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HA13 - Graph transformations • Questions 3-4

Q03 | 4 MARKS

The graph $y=f(x)$ is transformed to $y=2f(x+3)+1$. Describe the transformations in a valid order and map the point $(2,5)$. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

The graph $y=f(x)$ is transformed to $y=5f(x-0)-2$. Describe the transformations in a valid order and map the point $(2,5)$. Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HA13 - Graph transformations • Questions 5-6

Q05 | 4 MARKS

The graph $y=f(x)$ is transformed to $y=8f(x-3)+1$. Describe the transformations in a valid order and map the point (2,5). Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

The graph $y=f(x)$ is transformed to $y=4f(x+1)-2$. Describe the transformations in a valid order and map the point (2,5). Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HA13 - Graph transformations • Questions 7-8

Q07 | 4 MARKS

The graph $y=f(x)$ is transformed to $y=7f(x-2)+1$. Describe the transformations in a valid order and map the point (2,5). Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

The graph $y=f(x)$ is transformed to $y=3f(x+2)-2$. Describe the transformations in a valid order and map the point (2,5). Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HA13 - Graph transformations • Questions 9-10

Q09 | 4 MARKS

The graph $y=f(x)$ is transformed to $y=6f(x-1)+1$. Describe the transformations in a valid order and map the point (2,5). Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

The graph $y=f(x)$ is transformed to $y=2f(x+3)-2$. Describe the transformations in a valid order and map the point (2,5). Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HA13 - Graph transformations • Questions 11-12

Q11 | 5 MARKS

You must show your working. The graph $y=f(x)$ is transformed to $y=3f(x+2)-1$. Describe the transformations in a valid order and map the point (2,5). Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. The graph $y=f(x)$ is transformed to $y=4f(x+1)$. Describe the transformations in a valid order and map the point (2,5). Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 13

HA13 - Graph transformations • Questions 1-2

Q01 | 4 MARKS

$f(x+2)$ translates the graph 2 units left; multiplying by 3 gives a vertical stretch factor 3; the final term translates it 1 units up. Thus (2,5) maps to (0,16). Horizontal movement changes x-coordinates; vertical operations change y-coordinates. 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

$f(x-1)$ translates the graph 1 units right; multiplying by 6 gives a vertical stretch factor 6; the final term translates it 2 units down. Thus (2,5) maps to (3,28). Horizontal movement changes x-coordinates; vertical operations change y-coordinates. 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

HA13 - Graph transformations • Questions 3-4

Q03 | 4 MARKS

$f(x+3)$ translates the graph 3 units left; multiplying by 2 gives a vertical stretch factor 2; the final term translates it 1 units up. Thus (2,5) maps to (-1,11). Horizontal movement changes x-coordinates; vertical operations change y-coordinates. 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

$f(x-0)$ translates the graph 0 units horizontally; multiplying by 5 gives a vertical stretch factor 5; the final term translates it 2 units down. Thus (2,5) maps to (2,23). Horizontal movement changes x-coordinates; vertical operations change y-coordinates. 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

HA13 - Graph transformations • Questions 5-6

Q05 | 4 MARKS

$f(x-3)$ translates the graph 3 units right; multiplying by 8 gives a vertical stretch factor 8; the final term translates it 1 units up. Thus (2,5) maps to (5,41). Horizontal movement changes x-coordinates; vertical operations change y-coordinates. 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

$f(x+1)$ translates the graph 1 units left; multiplying by 4 gives a vertical stretch factor 4; the final term translates it 2 units down. Thus (2,5) maps to (1,18). Horizontal movement changes x-coordinates; vertical operations change y-coordinates. 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

HA13 - Graph transformations • Questions 7-8

Q07 | 4 MARKS

$f(x-2)$ translates the graph 2 units right; multiplying by 7 gives a vertical stretch factor 7; the final term translates it 1 units up. Thus (2,5) maps to (4,36). Horizontal movement changes x-coordinates; vertical operations change y-coordinates. 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

$f(x+2)$ translates the graph 2 units left; multiplying by 3 gives a vertical stretch factor 3; the final term translates it 2 units down. Thus (2,5) maps to (0,13). Horizontal movement changes x-coordinates; vertical operations change y-coordinates. 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

HA13 - Graph transformations • Questions 9-10

Q09 | 4 MARKS

$f(x-1)$ translates the graph 1 units right; multiplying by 6 gives a vertical stretch factor 6; the final term translates it 1 units up. Thus (2,5) maps to (3,31). Horizontal movement changes x-coordinates; vertical operations change y-coordinates. 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

$f(x+3)$ translates the graph 3 units left; multiplying by 2 gives a vertical stretch factor 2; the final term translates it 2 units down. Thus (2,5) maps to (-1,8). Horizontal movement changes x-coordinates; vertical operations change y-coordinates. 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

HA13 - Graph transformations • Questions 11-12

Q11 | 5 MARKS

$f(x+2)$ translates the graph 2 units left; multiplying by 3 gives a vertical stretch factor 3; the final term translates it 1 units down. Thus (2,5) maps to (0,14). Horizontal movement changes x-coordinates; vertical operations change y-coordinates. 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

$f(x+1)$ translates the graph 1 units left; multiplying by 4 gives a vertical stretch factor 4; the final term translates it 0 units vertically. Thus (2,5) maps to (1,20). Horizontal movement changes x-coordinates; vertical operations change y-coordinates. 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

HA13 - Graph transformations

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 2 • CHAPTER 14****HA14 - Graphs in real contexts****Chapter purpose**

Use non-standard graphs to obtain approximate solutions in kinematic and other settings.

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

HA14 - Graphs in real contexts

Specification focus

Use non-standard graphs to obtain approximate solutions in kinematic and other settings.

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

HA14 - Graphs in real contexts • Questions 1-2

Q01 | 4 MARKS

For $y=3x^2+1$, calculate the gradient of the chord from $x=0$ to $x=4$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Explain why a graphical approximation is appropriate and state its likely accuracy. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

For $y=6x^2+4$, calculate the gradient of the chord from $x=3$ to $x=7$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Explain why a graphical approximation is appropriate and state its likely accuracy. Your solution must justify the main method or assumption and include a final check.

Chapter 14 • Practice

HA14 - Graphs in real contexts • Questions 3-4

Q03 | 4 MARKS

For $y=2x^2+2$, calculate the gradient of the chord from $x=1$ to $x=5$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Explain why a graphical approximation is appropriate and state its likely accuracy. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

For $y=5x^2+5$, calculate the gradient of the chord from $x=4$ to $x=8$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Explain why a graphical approximation is appropriate and state its likely accuracy. Your solution must justify the main method or assumption and include a final check.

Chapter 14 • Practice

HA14 - Graphs in real contexts • Questions 5-6

Q05 | 4 MARKS

For $y=8x^2+3$, calculate the gradient of the chord from $x=2$ to $x=6$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Explain why a graphical approximation is appropriate and state its likely accuracy. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

For $y=4x^2+1$, calculate the gradient of the chord from $x=0$ to $x=4$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Explain why a graphical approximation is appropriate and state its likely accuracy. Your solution must justify the main method or assumption and include a final check.

Chapter 14 • Practice

HA14 - Graphs in real contexts • Questions 7-8

Q07 | 4 MARKS

For $y=7x^2+4$, calculate the gradient of the chord from $x=3$ to $x=7$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Explain why a graphical approximation is appropriate and state its likely accuracy. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

For $y=3x^2+2$, calculate the gradient of the chord from $x=1$ to $x=5$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Explain why a graphical approximation is appropriate and state its likely accuracy. Your solution must justify the main method or assumption and include a final check.

Chapter 14 • Practice

HA14 - Graphs in real contexts • Questions 9-10

Q09 | 4 MARKS

For $y=6x^2+5$, calculate the gradient of the chord from $x=4$ to $x=8$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Explain why a graphical approximation is appropriate and state its likely accuracy. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

For $y=2x^2+3$, calculate the gradient of the chord from $x=2$ to $x=6$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Explain why a graphical approximation is appropriate and state its likely accuracy. Your solution must justify the main method or assumption and include a final check.

Chapter 14 • Practice

HA14 - Graphs in real contexts • Questions 11-12

Q11 | 5 MARKS

You must show your working. For $y=3x^2+4$, calculate the gradient of the chord from $x=3$ to $x=7$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Explain why a graphical approximation is appropriate and state its likely accuracy. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. For $y=4x^2+5$, calculate the gradient of the chord from $x=4$ to $x=8$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Explain why a graphical approximation is appropriate and state its likely accuracy. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 14

HA14 - Graphs in real contexts • Questions 1-2

Q01 | 4 MARKS

Endpoint ordinates are 1 and 49. Chord gradient= $(49-1)/(4-0)=12$. One trapezium gives area= $1/2(1+49)(4)=100$ square units. The accuracy statement must be consistent with the graph scale or numerical information. 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

Endpoint ordinates are 58 and 298. Chord gradient= $(298-58)/(7-3)=60$. One trapezium gives area= $1/2(58+298)(4)=712$ square units. The accuracy statement must be consistent with the graph scale or numerical information. 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

HA14 - Graphs in real contexts • Questions 3-4

Q03 | 4 MARKS

Endpoint ordinates are 4 and 52. Chord gradient= $(52-4)/(5-1)=12$. One trapezium gives area= $1/2(4+52)(4)=112$ square units. The accuracy statement must be consistent with the graph scale or numerical information. 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

Endpoint ordinates are 85 and 325. Chord gradient= $(325-85)/(8-4)=60$. One trapezium gives area= $1/2(85+325)(4)=820$ square units. The accuracy statement must be consistent with the graph scale or numerical information. 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 14

HA14 - Graphs in real contexts • Questions 5-6

Q05 | 4 MARKS

Endpoint ordinates are 35 and 291. Chord gradient= $(291-35)/(6-2)=64$. One trapezium gives area= $1/2(35+291)(4)=652$ square units. The accuracy statement must be consistent with the graph scale or numerical information. 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

Endpoint ordinates are 1 and 65. Chord gradient= $(65-1)/(4-0)=16$. One trapezium gives area= $1/2(1+65)(4)=132$ square units. The accuracy statement must be consistent with the graph scale or numerical information. 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 14

HA14 - Graphs in real contexts • Questions 7-8

Q07 | 4 MARKS

Endpoint ordinates are 67 and 347. Chord gradient= $(347-67)/(7-3)=70$. One trapezium gives area= $1/2(67+347)(4)=828$ square units. The accuracy statement must be consistent with the graph scale or numerical information. 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

Endpoint ordinates are 5 and 77. Chord gradient= $(77-5)/(5-1)=18$. One trapezium gives area= $1/2(5+77)(4)=164$ square units. The accuracy statement must be consistent with the graph scale or numerical information. 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 14

HA14 - Graphs in real contexts • Questions 9-10

Q09 | 4 MARKS

Endpoint ordinates are 101 and 389. Chord gradient= $(389-101)/(8-4)=72$. One trapezium gives area= $1/2(101+389)(4)=980$ square units. The accuracy statement must be consistent with the graph scale or numerical information. 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

Endpoint ordinates are 11 and 75. Chord gradient= $(75-11)/(6-2)=16$. One trapezium gives area= $1/2(11+75)(4)=172$ square units. The accuracy statement must be consistent with the graph scale or numerical information. 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 14

HA14 - Graphs in real contexts • Questions 11-12

Q11 | 5 MARKS

Endpoint ordinates are 31 and 151. Chord gradient= $(151-31)/(7-3)=30$. One trapezium gives area= $1/2(31+151)(4)=364$ square units. The accuracy statement must be consistent with the graph scale or numerical information. 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

Endpoint ordinates are 69 and 261. Chord gradient= $(261-69)/(8-4)=48$. One trapezium gives area= $1/2(69+261)(4)=660$ square units. The accuracy statement must be consistent with the graph scale or numerical information. 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

HA14 - Graphs in real contexts

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 2 • CHAPTER 15****HA15 - Gradients and areas under graphs****Chapter purpose**

Estimate tangents and areas and interpret rates or accumulated quantities.

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

HA15 - Gradients and areas under graphs

Specification focus

Estimate tangents and areas and interpret rates or accumulated quantities.

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

HA15 - Gradients and areas under graphs • Questions 1-2

Q01 | 4 MARKS

For $y=3x^2+1$, calculate the gradient of the chord from $x=0$ to $x=4$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

For $y=6x^2+4$, calculate the gradient of the chord from $x=3$ to $x=7$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HA15 - Gradients and areas under graphs • Questions 3-4

Q03 | 4 MARKS

For $y=2x^2+2$, calculate the gradient of the chord from $x=1$ to $x=5$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

For $y=5x^2+5$, calculate the gradient of the chord from $x=4$ to $x=8$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HA15 - Gradients and areas under graphs • Questions 5-6

Q05 | 4 MARKS

For $y=8x^2+3$, calculate the gradient of the chord from $x=2$ to $x=6$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

For $y=4x^2+1$, calculate the gradient of the chord from $x=0$ to $x=4$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HA15 - Gradients and areas under graphs • Questions 7-8

Q07 | 4 MARKS

For $y=7x^2+4$, calculate the gradient of the chord from $x=3$ to $x=7$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

For $y=3x^2+2$, calculate the gradient of the chord from $x=1$ to $x=5$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HA15 - Gradients and areas under graphs • Questions 9-10

Q09 | 4 MARKS

For $y=6x^2+5$, calculate the gradient of the chord from $x=4$ to $x=8$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

For $y=2x^2+3$, calculate the gradient of the chord from $x=2$ to $x=6$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HA15 - Gradients and areas under graphs • Questions 11-12

Q11 | 5 MARKS

You must show your working. For $y=3x^2+4$, calculate the gradient of the chord from $x=3$ to $x=7$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. For $y=4x^2+5$, calculate the gradient of the chord from $x=4$ to $x=8$. Then find the trapezium estimate of the area under the curve using only the two endpoint ordinates. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 15

HA15 - Gradients and areas under graphs • Questions 1-2

Q01 | 4 MARKS

Endpoint ordinates are 1 and 49. Chord gradient= $(49-1)/(4-0)=12$. One trapezium gives area= $1/2(1+49)(4)=100$ square units. 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

Endpoint ordinates are 58 and 298. Chord gradient= $(298-58)/(7-3)=60$. One trapezium gives area= $1/2(58+298)(4)=712$ square units. 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

HA15 - Gradients and areas under graphs • Questions 3-4

Q03 | 4 MARKS

Endpoint ordinates are 4 and 52. Chord gradient= $(52-4)/(5-1)=12$. One trapezium gives area= $1/2(4+52)(4)=112$ square units. 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

Endpoint ordinates are 85 and 325. Chord gradient= $(325-85)/(8-4)=60$. One trapezium gives area= $1/2(85+325)(4)=820$ square units. 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

HA15 - Gradients and areas under graphs • Questions 5-6

Q05 | 4 MARKS

Endpoint ordinates are 35 and 291. Chord gradient= $(291-35)/(6-2)=64$. One trapezium gives area= $1/2(35+291)(4)=652$ square units. 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

Endpoint ordinates are 1 and 65. Chord gradient= $(65-1)/(4-0)=16$. One trapezium gives area= $1/2(1+65)(4)=132$ square units. 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

HA15 - Gradients and areas under graphs • Questions 7-8

Q07 | 4 MARKS

Endpoint ordinates are 67 and 347. Chord gradient= $(347-67)/(7-3)=70$. One trapezium gives area= $1/2(67+347)(4)=828$ square units. 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

Endpoint ordinates are 5 and 77. Chord gradient= $(77-5)/(5-1)=18$. One trapezium gives area= $1/2(5+77)(4)=164$ square units. 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

HA15 - Gradients and areas under graphs • Questions 9-10

Q09 | 4 MARKS

Endpoint ordinates are 101 and 389. Chord gradient= $(389-101)/(8-4)=72$. One trapezium gives area= $1/2(101+389)(4)=980$ square units. 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

Endpoint ordinates are 11 and 75. Chord gradient= $(75-11)/(6-2)=16$. One trapezium gives area= $1/2(11+75)(4)=172$ square units. 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

HA15 - Gradients and areas under graphs • Questions 11-12

Q11 | 5 MARKS

Endpoint ordinates are 31 and 151. Chord gradient= $(151-31)/(7-3)=30$. One trapezium gives area= $1/2(31+151)(4)=364$ square units. 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

Endpoint ordinates are 69 and 261. Chord gradient= $(261-69)/(8-4)=48$. One trapezium gives area= $1/2(69+261)(4)=660$ square units. 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

HA15 - Gradients and areas under graphs

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 2 • CHAPTER 16****HA16 - Circle equations and tangents****Chapter purpose**

Use circles centred at the origin and perpendicular-gradient reasoning for tangents.

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

HA16 - Circle equations and tangents

Specification focus

Use circles centred at the origin and perpendicular-gradient reasoning for tangents.

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

HA16 - Circle equations and tangents • Questions 1-2

Q01 | 4 MARKS

A circle has equation $(x+2)^2+(y+2)^2=36$. State its centre and radius, verify $(4,-2)$ lies on it, and find the tangent there. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A circle has equation $(x-1)^2+(y-1)^2=9$. State its centre and radius, verify $(4,1)$ lies on it, and find the tangent there. Your solution must justify the main method or assumption and include a final check.

Chapter 16 • Practice

HA16 - Circle equations and tangents • Questions 3-4

Q03 | 4 MARKS

A circle has equation $(x+3)^2+(y+1)^2=36$. State its centre and radius, verify $(3,-1)$ lies on it, and find the tangent there. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A circle has equation $(x-0)^2+(y-2)^2=9$. State its centre and radius, verify $(3,2)$ lies on it, and find the tangent there. Your solution must justify the main method or assumption and include a final check.

Chapter 16 • Practice

HA16 - Circle equations and tangents • Questions 5-6

Q05 | 4 MARKS

A circle has equation $(x-3)^2+(y-0)^2=36$. State its centre and radius, verify (9,0) lies on it, and find the tangent there. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A circle has equation $(x+1)^2+(y+2)^2=9$. State its centre and radius, verify (2,-2) lies on it, and find the tangent there. Your solution must justify the main method or assumption and include a final check.

Chapter 16 • Practice

HA16 - Circle equations and tangents • Questions 7-8

Q07 | 4 MARKS

A circle has equation $(x-2)^2+(y-1)^2=36$. State its centre and radius, verify (8,1) lies on it, and find the tangent there. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A circle has equation $(x+2)^2+(y+1)^2=9$. State its centre and radius, verify (1,-1) lies on it, and find the tangent there. Your solution must justify the main method or assumption and include a final check.

Chapter 16 • Practice

HA16 - Circle equations and tangents • Questions 9-10

Q09 | 4 MARKS

A circle has equation $(x-1)^2+(y-2)^2=36$. State its centre and radius, verify (7,2) lies on it, and find the tangent there. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

A circle has equation $(x+3)^2+(y-0)^2=9$. State its centre and radius, verify (0,0) lies on it, and find the tangent there. Your solution must justify the main method or assumption and include a final check.

Chapter 16 • Practice

HA16 - Circle equations and tangents • Questions 11-12

Q11 | 5 MARKS

You must show your working. A circle has equation $(x+2)^2+(y-1)^2=16$. State its centre and radius, verify $(2,1)$ lies on it, and find the tangent there. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A circle has equation $(x+1)^2+(y-2)^2=25$. State its centre and radius, verify $(4,2)$ lies on it, and find the tangent there. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 16

HA16 - Circle equations and tangents • Questions 1-2

Q01 | 4 MARKS

The centre is $(-2, -2)$ and radius 6. Substitution gives $6^2 + 0^2 = 36$. The radius to $(4, -2)$ is horizontal, so the tangent is vertical: $x = 4$. 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 Q01.

Q02 | 4 MARKS

The centre is $(1, 1)$ and radius 3. Substitution gives $3^2 + 0^2 = 9$. The radius to $(4, 1)$ is horizontal, so the tangent is vertical: $x = 4$. 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 Q02.

Worked solutions • Chapter 16

HA16 - Circle equations and tangents • Questions 3-4

Q03 | 4 MARKS

The centre is $(-3, -1)$ and radius 6. Substitution gives $6^2 + 0^2 = 36$. The radius to $(3, -1)$ is horizontal, so the tangent is vertical: $x = 3$. 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

The centre is $(0, 2)$ and radius 3. Substitution gives $3^2 + 0^2 = 9$. The radius to $(3, 2)$ is horizontal, so the tangent is vertical: $x = 3$. 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

HA16 - Circle equations and tangents • Questions 5-6

Q05 | 4 MARKS

The centre is (3,0) and radius 6. Substitution gives $6^2 + 0^2 = 36$. The radius to (9,0) is horizontal, so the tangent is vertical: $x=9$. 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 Q05.

Q06 | 4 MARKS

The centre is (-1,-2) and radius 3. Substitution gives $3^2 + 0^2 = 9$. The radius to (2,-2) is horizontal, so the tangent is vertical: $x=2$. 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 16

HA16 - Circle equations and tangents • Questions 7-8

Q07 | 4 MARKS

The centre is (2,1) and radius 6. Substitution gives $6^2 + 0^2 = 36$. The radius to (8,1) is horizontal, so the tangent is vertical: $x=8$. 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 Q07.

Q08 | 4 MARKS

The centre is (-2,-1) and radius 3. Substitution gives $3^2 + 0^2 = 9$. The radius to (1,-1) is horizontal, so the tangent is vertical: $x=1$. 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 16

HA16 - Circle equations and tangents • Questions 9-10

Q09 | 4 MARKS

The centre is (1,2) and radius 6. Substitution gives $6^2 + 0^2 = 36$. The radius to (7,2) is horizontal, so the tangent is vertical: $x=7$. 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 Q09.

Q10 | 4 MARKS

The centre is (-3,0) and radius 3. Substitution gives $3^2 + 0^2 = 9$. The radius to (0,0) is horizontal, so the tangent is vertical: $x=0$. 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

HA16 - Circle equations and tangents • Questions 11-12

Q11 | 5 MARKS

The centre is $(-2,1)$ and radius 4. Substitution gives $4^2 + 0^2 = 16$. The radius to $(2,1)$ is horizontal, so the tangent is vertical: $x=2$. 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

The centre is $(-1,2)$ and radius 5. Substitution gives $5^2 + 0^2 = 25$. The radius to $(4,2)$ is horizontal, so the tangent is vertical: $x=4$. 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 Q12.

Chapter 16 • Completion and retest record

HA16 - Circle equations and tangents

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 2 • CHAPTER 17****HA17 - Linear equations****Chapter purpose**

Solve equations algebraically and approximately, including fractional forms and validity checks.

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

HA17 - Linear equations

Specification focus

Solve equations algebraically and approximately, including fractional forms and validity checks.

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

HA17 - Linear equations • Questions 1-2

Q01 | 4 MARKS

Solve $3/(x-4)+1=5$. State the excluded value and verify the solution in the original equation. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Solve $6/(x-1)+4=11$. State the excluded value and verify the solution in the original equation. Your solution must justify the main method or assumption and include a final check.

Chapter 17 • Practice

HA17 - Linear equations • Questions 3-4

Q03 | 4 MARKS

Solve $2/(x-4)+2=5$. State the excluded value and verify the solution in the original equation. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Solve $5/(x-1)+5=11$. State the excluded value and verify the solution in the original equation. Your solution must justify the main method or assumption and include a final check.

Chapter 17 • Practice

HA17 - Linear equations • Questions 5-6

Q05 | 4 MARKS

Solve $8/(x-4)+3=12$. State the excluded value and verify the solution in the original equation. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Solve $4/(x-1)+1=6$. State the excluded value and verify the solution in the original equation. Your solution must justify the main method or assumption and include a final check.

Chapter 17 • Practice

HA17 - Linear equations • Questions 7-8

Q07 | 4 MARKS

Solve $7/(x-4)+4=12$. State the excluded value and verify the solution in the original equation. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Solve $3/(x-1)+2=6$. State the excluded value and verify the solution in the original equation. Your solution must justify the main method or assumption and include a final check.

Chapter 17 • Practice

HA17 - Linear equations • Questions 9-10

Q09 | 4 MARKS

Solve $6/(x-4)+5=12$. State the excluded value and verify the solution in the original equation. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

Solve $2/(x-1)+3=6$. State the excluded value and verify the solution in the original equation. Your solution must justify the main method or assumption and include a final check.

Chapter 17 • Practice

HA17 - Linear equations • Questions 11-12

Q11 | 5 MARKS

You must show your working. Solve $3/(x-2)+4=8$. State the excluded value and verify the solution in the original equation. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. Solve $4/(x-3)+5=10$. State the excluded value and verify the solution in the original equation. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 17

HA17 - Linear equations • Questions 1-2

Q01 | 4 MARKS

Restriction: $x \neq 4$. Then $3/(x-4)=4$, so $x-4=3/4$ and $x=19/4$. Substitution returns 5; the solution is not excluded. 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

Restriction: $x \neq 1$. Then $6/(x-1)=7$, so $x-1=6/7$ and $x=13/7$. Substitution returns 11; the solution is not excluded. 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

HA17 - Linear equations • Questions 3-4

Q03 | 4 MARKS

Restriction: $x \neq 4$. Then $2/(x-4)=3$, so $x-4=2/3$ and $x=14/3$. Substitution returns 5; the solution is not excluded. 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

Restriction: $x \neq 1$. Then $5/(x-1)=6$, so $x-1=5/6$ and $x=11/6$. Substitution returns 11; the solution is not excluded. 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

HA17 - Linear equations • Questions 5-6

Q05 | 4 MARKS

Restriction: $x \neq 4$. Then $8/(x-4)=9$, so $x-4=8/9$ and $x=44/9$. Substitution returns 12; the solution is not excluded. 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

Restriction: $x \neq 1$. Then $4/(x-1)=5$, so $x-1=4/5$ and $x=9/5$. Substitution returns 6; the solution is not excluded. 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 17

HA17 - Linear equations • Questions 7-8

Q07 | 4 MARKS

Restriction: $x \neq 4$. Then $7/(x-4)=8$, so $x-4=7/8$ and $x=39/8$. Substitution returns 12; the solution is not excluded. 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

Restriction: $x \neq 1$. Then $3/(x-1)=4$, so $x-1=3/4$ and $x=7/4$. Substitution returns 6; the solution is not excluded. 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 17

HA17 - Linear equations • Questions 9-10

Q09 | 4 MARKS

Restriction: $x \neq 4$. Then $6/(x-4)=7$, so $x-4=6/7$ and $x=34/7$. Substitution returns 12; the solution is not excluded. 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

Restriction: $x \neq 1$. Then $2/(x-1)=3$, so $x-1=2/3$ and $x=5/3$. Substitution returns 6; the solution is not excluded. 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 17

HA17 - Linear equations • Questions 11-12

Q11 | 5 MARKS

Restriction: $x \neq 2$. Then $3/(x-2)=4$, so $x-2=3/4$ and $x=11/4$. Substitution returns 8; the solution is not excluded. 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

Restriction: $x \neq 3$. Then $4/(x-3)=5$, so $x-3=4/5$ and $x=19/5$. Substitution returns 10; the solution is not excluded. 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

HA17 - Linear equations

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 2 • CHAPTER 18****HA18 - Quadratic equations****Chapter purpose**

Solve by factorising, completing the square, the quadratic formula and graphs.

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

HA18 - Quadratic equations

Specification focus

Solve by factorising, completing the square, the quadratic formula and graphs.

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

HA18 - Quadratic equations • Questions 1-2

Q01 | 4 MARKS

Solve $1x^2+3x-5=0$ using the quadratic formula. Give exact roots and three-decimal approximations. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Solve $1x^2+6x-2=0$ using the quadratic formula. Give exact roots and three-decimal approximations. Your solution must justify the main method or assumption and include a final check.

Chapter 18 • Practice

HA18 - Quadratic equations • Questions 3-4

Q03 | 4 MARKS

Solve $1x^2+2x-5=0$ using the quadratic formula. Give exact roots and three-decimal approximations. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Solve $1x^2+5x-2=0$ using the quadratic formula. Give exact roots and three-decimal approximations. Your solution must justify the main method or assumption and include a final check.

Chapter 18 • Practice

HA18 - Quadratic equations • Questions 5-6

Q05 | 4 MARKS

Solve $1x^2+8x-5=0$ using the quadratic formula. Give exact roots and three-decimal approximations. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Solve $1x^2+4x-2=0$ using the quadratic formula. Give exact roots and three-decimal approximations. Your solution must justify the main method or assumption and include a final check.

Chapter 18 • Practice

HA18 - Quadratic equations • Questions 7-8

Q07 | 4 MARKS

Solve $1x^2+7x-5=0$ using the quadratic formula. Give exact roots and three-decimal approximations. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Solve $1x^2+3x-2=0$ using the quadratic formula. Give exact roots and three-decimal approximations. Your solution must justify the main method or assumption and include a final check.

Chapter 18 • Practice

HA18 - Quadratic equations • Questions 9-10

Q09 | 4 MARKS

Solve $1x^2+6x-5=0$ using the quadratic formula. Give exact roots and three-decimal approximations. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

Solve $1x^2+2x-2=0$ using the quadratic formula. Give exact roots and three-decimal approximations. Your solution must justify the main method or assumption and include a final check.

Chapter 18 • Practice

HA18 - Quadratic equations • Questions 11-12

Q11 | 5 MARKS

You must show your working. Solve $2x^2 + 3x - 3 = 0$ using the quadratic formula. Give exact roots and three-decimal approximations. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. Solve $3x^2 + 4x - 4 = 0$ using the quadratic formula. Give exact roots and three-decimal approximations. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 18

HA18 - Quadratic equations • Questions 1-2

Q01 | 4 MARKS

With $a=1$, $b=3$, $c=-5$, discriminant $=3^2-4(1)(-5)=29$. Thus $x=(-3 \text{ plus or minus } \sqrt{29})/2$. Exact roots are $-3/2 + \sqrt{29}/2$ and $-\sqrt{29}/2 - 3/2$; approximately 1.193 and -4.193. 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

With $a=1$, $b=6$, $c=-2$, discriminant $=6^2-4(1)(-2)=44$. Thus $x=(-6 \text{ plus or minus } \sqrt{44})/2$. Exact roots are $-3 + \sqrt{11}$ and $-\sqrt{11} - 3$; approximately 0.317 and -6.317. 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

HA18 - Quadratic equations • Questions 3-4

Q03 | 4 MARKS

With $a=1$, $b=2$, $c=-5$, discriminant $=2^2-4(1)(-5)=24$. Thus $x=(-2 \text{ plus or minus } \sqrt{24})/2$. Exact roots are $-1 + \sqrt{6}$ and $-\sqrt{6} - 1$; approximately 1.449 and -3.449. 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

With $a=1$, $b=5$, $c=-2$, discriminant $=5^2-4(1)(-2)=33$. Thus $x=(-5 \text{ plus or minus } \sqrt{33})/2$. Exact roots are $-5/2 + \sqrt{33}/2$ and $-\sqrt{33}/2 - 5/2$; approximately 0.372 and -5.372. 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

HA18 - Quadratic equations • Questions 5-6

Q05 | 4 MARKS

With $a=1$, $b=8$, $c=-5$, discriminant $=8^2-4(1)(-5)=84$. Thus $x=(-8 \text{ plus or minus } \sqrt{84})/2$. Exact roots are $-4 + \sqrt{21}$ and $-\sqrt{21} - 4$; approximately 0.583 and -8.583. 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

With $a=1$, $b=4$, $c=-2$, discriminant $=4^2-4(1)(-2)=24$. Thus $x=(-4 \text{ plus or minus } \sqrt{24})/2$. Exact roots are $-2 + \sqrt{6}$ and $-\sqrt{6} - 2$; approximately 0.449 and -4.449. 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 18

HA18 - Quadratic equations • Questions 7-8

Q07 | 4 MARKS

With $a=1$, $b=7$, $c=-5$, discriminant $=7^2-4(1)(-5)=69$. Thus $x=(-7 \text{ plus or minus } \sqrt{69})/2$. Exact roots are $-7/2 + \sqrt{69}/2$ and $-\sqrt{69}/2 - 7/2$; approximately 0.653 and -7.653. 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

With $a=1$, $b=3$, $c=-2$, discriminant $=3^2-4(1)(-2)=17$. Thus $x=(-3 \text{ plus or minus } \sqrt{17})/2$. Exact roots are $-3/2 + \sqrt{17}/2$ and $-\sqrt{17}/2 - 3/2$; approximately 0.562 and -3.562. 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 18

HA18 - Quadratic equations • Questions 9-10

Q09 | 4 MARKS

With $a=1$, $b=6$, $c=-5$, discriminant $=6^2-4(1)(-5)=56$. Thus $x=(-6 \text{ plus or minus } \sqrt{56})/2$. Exact roots are $-3 + \sqrt{14}$ and $-\sqrt{14} - 3$; approximately 0.742 and -6.742. 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

With $a=1$, $b=2$, $c=-2$, discriminant $=2^2-4(1)(-2)=12$. Thus $x=(-2 \text{ plus or minus } \sqrt{12})/2$. Exact roots are $-1 + \sqrt{3}$ and $-\sqrt{3} - 1$; approximately 0.732 and -2.732. 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 18

HA18 - Quadratic equations • Questions 11-12

Q11 | 5 MARKS

With $a=2$, $b=3$, $c=-3$, discriminant $=3^2-4(2)(-3)=33$. Thus $x=(-3 \text{ plus or minus } \sqrt{33})/4$. Exact roots are $-3/4 + \sqrt{33}/4$ and $-\sqrt{33}/4 - 3/4$; approximately 0.686 and -2.186. 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

With $a=3$, $b=4$, $c=-4$, discriminant $=4^2-4(3)(-4)=64$. Thus $x=(-4 \text{ plus or minus } \sqrt{64})/6$. Exact roots are -2 and $2/3$; approximately -2.000 and 0.667. 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 18 • Completion and retest record

HA18 - Quadratic equations

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 2 • CHAPTER 19****HA19 - Simultaneous equations****Chapter purpose**

Solve linear-linear and linear-quadratic systems and interpret intersections.

Higher reasoning expectation

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

Chapter 19 • Method and assessment map

HA19 - Simultaneous equations

Specification focus

Solve linear-linear and linear-quadratic systems and interpret intersections.

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 19 • Practice

HA19 - Simultaneous equations • Questions 1-2

Q01 | 4 MARKS

Solve simultaneously $y=4x-2$ and $x^2+y^2=5$. Give every intersection and verify both equations. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Solve simultaneously $y=3x+1$ and $x^2+y^2=185$. Give every intersection and verify both equations.

Chapter 19 • Practice

HA19 - Simultaneous equations • Questions 3-4

Q03 | 4 MARKS

Solve simultaneously $y=2x-3$ and $x^2+y^2=5$. Give every intersection and verify both equations. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Solve simultaneously $y=x$ and $x^2+y^2=50$. Give every intersection and verify both equations. Your solution must justify the main method or assumption and include a final check.

Chapter 19 • Practice

HA19 - Simultaneous equations • Questions 5-6

Q05 | 4 MARKS

Solve simultaneously $y=4x+3$ and $x^2+y^2=234$. Give every intersection and verify both equations.

Q06 | 4 MARKS

Solve simultaneously $y=3x-1$ and $x^2+y^2=5$. Give every intersection and verify both equations. Your solution must justify the main method or assumption and include a final check.

Chapter 19 • Practice

HA19 - Simultaneous equations • Questions 7-8

Q07 | 4 MARKS

Solve simultaneously $y=2x+2$ and $x^2+y^2=116$. Give every intersection and verify both equations.

Q08 | 4 MARKS

Solve simultaneously $y=x-2$ and $x^2+y^2=4$. Give every intersection and verify both equations. Your solution must justify the main method or assumption and include a final check.

Chapter 19 • Practice

HA19 - Simultaneous equations • Questions 9-10

Q09 | 4 MARKS

Solve simultaneously $y=4x+1$ and $x^2+y^2=466$. Give every intersection and verify both equations.

Q10 | 4 MARKS

Solve simultaneously $y=3x-3$ and $x^2+y^2=45$. Give every intersection and verify both equations.

Chapter 19 • Practice

HA19 - Simultaneous equations • Questions 11-12

Q11 | 5 MARKS

You must show your working. Solve simultaneously $y=4x-2$ and $x^2+y^2=212$. Give every intersection and verify both equations.

Q12 | 6 MARKS

You must show your working. Solve simultaneously $y=x-1$ and $x^2+y^2=41$. Give every intersection and verify both equations. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 19

HA19 - Simultaneous equations • Questions 1-2

Q01 | 4 MARKS

Substitution gives $17x^2 - 16x - 1 = 0$, with x-values $-1/17, 1$. Hence intersections are $[(-1/17, -38/17), (1, 2)]$. Substituting each point satisfies the line and gives $x^2 + y^2 = 5$. 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

Substitution gives $10x^2 + 6x - 184 = 0$, with x-values $-23/5, 4$. Hence intersections are $[(-23/5, -64/5), (4, 13)]$. Substituting each point satisfies the line and gives $x^2 + y^2 = 185$. 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 19

HA19 - Simultaneous equations • Questions 3-4

Q03 | 4 MARKS

Substitution gives $5x^2 - 12x + 4 = 0$, with x-values $\frac{2}{5}$, 2. Hence intersections are $[(\frac{2}{5}, -\frac{11}{5}), (2, 1)]$. Substituting each point satisfies the line and gives $x^2 + y^2 = 5$. 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 Q03.

Q04 | 4 MARKS

Substitution gives $2x^2 - 50 = 0$, with x-values -5, 5. Hence intersections are $[(-5, -5), (5, 5)]$. Substituting each point satisfies the line and gives $x^2 + y^2 = 50$. 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 19

HA19 - Simultaneous equations • Questions 5-6

Q05 | 4 MARKS

Substitution gives $17x^2 + 24x - 225 = 0$, with x-values $-75/17, 3$. Hence intersections are $[(-75/17, -249/17), (3, 15)]$. Substituting each point satisfies the line and gives $x^2 + y^2 = 234$. 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

Substitution gives $10x^2 - 6x - 4 = 0$, with x-values $-2/5, 1$. Hence intersections are $[(-2/5, -11/5), (1, 2)]$. Substituting each point satisfies the line and gives $x^2 + y^2 = 5$. 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 Q06.

Worked solutions • Chapter 19

HA19 - Simultaneous equations • Questions 7-8

Q07 | 4 MARKS

Substitution gives $5x^2 + 8x - 112 = 0$, with x-values $-28/5, 4$. Hence intersections are $((-28/5, -46/5), (4, 10))$. Substituting each point satisfies the line and gives $x^2 + y^2 = 116$. 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

Substitution gives $2x^2 - 4x = 0$, with x-values 0, 2. Hence intersections are $((0, -2), (2, 0))$. Substituting each point satisfies the line and gives $x^2 + y^2 = 4$. 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 Q08.

Worked solutions • Chapter 19

HA19 - Simultaneous equations • Questions 9-10

Q09 | 4 MARKS

Substitution gives $17x^2 + 8x - 465 = 0$, with x-values $-93/17, 5$. Hence intersections are $[(-93/17, -355/17), (5, 21)]$. Substituting each point satisfies the line and gives $x^2 + y^2 = 466$. 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

Substitution gives $10x^2 - 18x - 36 = 0$, with x-values $-6/5, 3$. Hence intersections are $[(-6/5, -33/5), (3, 6)]$. Substituting each point satisfies the line and gives $x^2 + y^2 = 45$. 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 Q10.

Worked solutions • Chapter 19

HA19 - Simultaneous equations • Questions 11-12

Q11 | 5 MARKS

Substitution gives $17x^2 - 16x - 208 = 0$, with x-values $-52/17, 4$. Hence intersections are $(-52/17, -242/17), (4, 14)$. Substituting each point satisfies the line and gives $x^2 + y^2 = 212$. 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

Substitution gives $2x^2 - 2x - 40 = 0$, with x-values $-4, 5$. Hence intersections are $(-4, -5), (5, 4)$. Substituting each point satisfies the line and gives $x^2 + y^2 = 41$. 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 19 • Completion and retest record

HA19 - Simultaneous equations

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 2 • CHAPTER 20****HA20 - Numerical methods and iteration****Chapter purpose**

Use trial and improvement, decimal search, bisection and iterative rearrangements responsibly.

Higher reasoning expectation

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

Chapter 20 • Method and assessment map

HA20 - Numerical methods and iteration

Specification focus

Use trial and improvement, decimal search, bisection and iterative rearrangements responsibly.

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 20 • Practice

HA20 - Numerical methods and iteration • Questions 1-2

Q01 | 4 MARKS

Use $x_{(n+1)} = 0.5(x_n + 3/x_n)$ with $x_1 = 1.0$ to find x_4 . Give six decimal places and explain what equation the fixed point satisfies. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Use $x_{(n+1)} = 0.5(x_n + 6/x_n)$ with $x_1 = 1.0$ to find x_4 . Give six decimal places and explain what equation the fixed point satisfies. Your solution must justify the main method or assumption and include a final check.

Chapter 20 • Practice

HA20 - Numerical methods and iteration • Questions 3-4

Q03 | 4 MARKS

Use $x_{n+1} = 0.5(x_n + 2/x_n)$ with $x_1 = 1.0$ to find x_4 . Give six decimal places and explain what equation the fixed point satisfies. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Use $x_{n+1} = 0.5(x_n + 5/x_n)$ with $x_1 = 1.0$ to find x_4 . Give six decimal places and explain what equation the fixed point satisfies. Your solution must justify the main method or assumption and include a final check.

Chapter 20 • Practice

HA20 - Numerical methods and iteration • Questions 5-6

Q05 | 4 MARKS

Use $x_{(n+1)} = 0.5(x_n + 8/x_n)$ with $x_1 = 1.0$ to find x_4 . Give six decimal places and explain what equation the fixed point satisfies. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Use $x_{(n+1)} = 0.5(x_n + 4/x_n)$ with $x_1 = 1.0$ to find x_4 . Give six decimal places and explain what equation the fixed point satisfies. Your solution must justify the main method or assumption and include a final check.

Chapter 20 • Practice

HA20 - Numerical methods and iteration • Questions 7-8

Q07 | 4 MARKS

Use $x_{(n+1)} = 0.5(x_n + 7/x_n)$ with $x_1 = 1.0$ to find x_4 . Give six decimal places and explain what equation the fixed point satisfies. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Use $x_{(n+1)} = 0.5(x_n + 3/x_n)$ with $x_1 = 1.0$ to find x_4 . Give six decimal places and explain what equation the fixed point satisfies. 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 20 • Practice

HA20 - Numerical methods and iteration • Questions 9-10

Q09 | 4 MARKS

Use $x_{(n+1)} = 0.5(x_n + 6/x_n)$ with $x_1 = 1.0$ to find x_4 . Give six decimal places and explain what equation the fixed point satisfies. 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

Use $x_{(n+1)} = 0.5(x_n + 2/x_n)$ with $x_1 = 1.0$ to find x_4 . Give six decimal places and explain what equation the fixed point satisfies. 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 20 • Practice

HA20 - Numerical methods and iteration • Questions 11-12

Q11 | 5 MARKS

You must show your working. Use $x_{n+1} = 0.5(x_n + 3/x_n)$ with $x_1 = 1.5$ to find x_4 . Give six decimal places and explain what equation the fixed point satisfies. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. Use $x_{n+1} = 0.5(x_n + 4/x_n)$ with $x_1 = 2.0$ to find x_4 . Give six decimal places and explain what equation the fixed point satisfies. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 20

HA20 - Numerical methods and iteration • Questions 1-2

Q01 | 4 MARKS

Iterations: $x_2=2.000000$, $x_3=1.750000$, $x_4=1.732143$. At a fixed point $x=0.5(x+3/x)$, so $x^2=3$; the positive iteration approaches $\sqrt{3}$. 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

Iterations: $x_2=3.500000$, $x_3=2.607143$, $x_4=2.454256$. At a fixed point $x=0.5(x+6/x)$, so $x^2=6$; the positive iteration approaches $\sqrt{6}$. 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 Q02.

Worked solutions • Chapter 20

HA20 - Numerical methods and iteration • Questions 3-4

Q03 | 4 MARKS

Iterations: $x_2=1.500000$, $x_3=1.416667$, $x_4=1.414216$. At a fixed point $x=0.5(x+2/x)$, so $x^2=2$; the positive iteration approaches $\sqrt{2}$. 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

Iterations: $x_2=3.000000$, $x_3=2.333333$, $x_4=2.238095$. At a fixed point $x=0.5(x+5/x)$, so $x^2=5$; the positive iteration approaches $\sqrt{5}$. 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 Q04.

Worked solutions • Chapter 20

HA20 - Numerical methods and iteration • Questions 5-6

Q05 | 4 MARKS

Iterations: $x_2=4.500000$, $x_3=3.138889$, $x_4=2.843781$. At a fixed point $x=0.5(x+8/x)$, so $x^2=8$; the positive iteration approaches $\sqrt{8}$. 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 Q05.

Q06 | 4 MARKS

Iterations: $x_2=2.500000$, $x_3=2.050000$, $x_4=2.000610$. At a fixed point $x=0.5(x+4/x)$, so $x^2=4$; the positive iteration approaches $\sqrt{4}$. 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 Q06.

Worked solutions • Chapter 20

HA20 - Numerical methods and iteration • Questions 7-8

Q07 | 4 MARKS

Iterations: $x_2=4.000000$, $x_3=2.875000$, $x_4=2.654891$. At a fixed point $x=0.5(x+7/x)$, so $x^2=7$; the positive iteration approaches $\sqrt{7}$. 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 Q07.

Q08 | 4 MARKS

Iterations: $x_2=2.000000$, $x_3=1.750000$, $x_4=1.732143$. At a fixed point $x=0.5(x+3/x)$, so $x^2=3$; the positive iteration approaches $\sqrt{3}$. 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 20

HA20 - Numerical methods and iteration • Questions 9-10

Q09 | 4 MARKS

Iterations: $x_2=3.500000$, $x_3=2.607143$, $x_4=2.454256$. At a fixed point $x=0.5(x+6/x)$, so $x^2=6$; the positive iteration approaches $\sqrt{6}$. 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

Iterations: $x_2=1.500000$, $x_3=1.416667$, $x_4=1.414216$. At a fixed point $x=0.5(x+2/x)$, so $x^2=2$; the positive iteration approaches $\sqrt{2}$. 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 20

HA20 - Numerical methods and iteration • Questions 11-12

Q11 | 5 MARKS

Iterations: $x_2=1.750000$, $x_3=1.732143$, $x_4=1.732051$. At a fixed point $x=0.5(x+3/x)$, so $x^2=3$; the positive iteration approaches $\sqrt{3}$. 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

Iterations: $x_2=2.000000$, $x_3=2.000000$, $x_4=2.000000$. At a fixed point $x=0.5(x+4/x)$, so $x^2=4$; the positive iteration approaches $\sqrt{4}$. 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 Q12.

Chapter 20 • Completion and retest record

HA20 - Numerical methods and iteration

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 2 • CHAPTER 21****HA21 - Algebraic modelling****Chapter purpose**

Translate a situation into equations or formulae, solve and interpret the model.

Higher reasoning expectation

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

Chapter 21 • Method and assessment map

HA21 - Algebraic modelling

Specification focus

Translate a situation into equations or formulae, solve and interpret the model.

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 21 • Practice

HA21 - Algebraic modelling • Questions 1-2

Q01 | 4 MARKS

A rectangle has perimeter 36 cm. Its width is x cm. Form a quadratic for its area, find the maximum area exactly, and decide whether width 12 cm gives at least 90% of the maximum. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A rectangle has perimeter 30 cm. Its width is x cm. Form a quadratic for its area, find the maximum area exactly, and decide whether width 7 cm gives at least 90% of the maximum. Your solution must justify the main method or assumption and include a final check.

Chapter 21 • Practice

HA21 - Algebraic modelling • Questions 3-4

Q03 | 4 MARKS

A rectangle has perimeter 36 cm. Its width is x cm. Form a quadratic for its area, find the maximum area exactly, and decide whether width 10 cm gives at least 90% of the maximum. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A rectangle has perimeter 30 cm. Its width is x cm. Form a quadratic for its area, find the maximum area exactly, and decide whether width 5 cm gives at least 90% of the maximum. Your solution must justify the main method or assumption and include a final check.

Chapter 21 • Practice

HA21 - Algebraic modelling • Questions 5-6

Q05 | 4 MARKS

A rectangle has perimeter 36 cm. Its width is x cm. Form a quadratic for its area, find the maximum area exactly, and decide whether width 8 cm gives at least 90% of the maximum. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A rectangle has perimeter 30 cm. Its width is x cm. Form a quadratic for its area, find the maximum area exactly, and decide whether width 11 cm gives at least 90% of the maximum. Your solution must justify the main method or assumption and include a final check.

Chapter 21 • Practice

HA21 - Algebraic modelling • Questions 7-8

Q07 | 4 MARKS

A rectangle has perimeter 36 cm. Its width is x cm. Form a quadratic for its area, find the maximum area exactly, and decide whether width 6 cm gives at least 90% of the maximum. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A rectangle has perimeter 30 cm. Its width is x cm. Form a quadratic for its area, find the maximum area exactly, and decide whether width 9 cm gives at least 90% of the maximum. Your solution must justify the main method or assumption and include a final check.

Chapter 21 • Practice

HA21 - Algebraic modelling • Questions 9-10

Q09 | 4 MARKS

A rectangle has perimeter 36 cm. Its width is x cm. Form a quadratic for its area, find the maximum area exactly, and decide whether width 12 cm gives at least 90% of the maximum. 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 rectangle has perimeter 30 cm. Its width is x cm. Form a quadratic for its area, find the maximum area exactly, and decide whether width 7 cm gives at least 90% of the maximum. 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 21 • Practice

HA21 - Algebraic modelling • Questions 11-12

Q11 | 5 MARKS

You must show your working. A rectangle has perimeter 32 cm. Its width is x cm. Form a quadratic for its area, find the maximum area exactly, and decide whether width 8 cm gives at least 90% of the maximum. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A rectangle has perimeter 34 cm. Its width is x cm. Form a quadratic for its area, find the maximum area exactly, and decide whether width 9 cm gives at least 90% of the maximum. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 21

HA21 - Algebraic modelling • Questions 1-2

Q01 | 4 MARKS

Length=18-x, so $A=x(18-x)=-x^2+18x$. Completing the square or symmetry gives maximum at $x=9$, with $A=81 \text{ cm}^2$. For $x=12$, $A=72$, which is 88.9% of the maximum; therefore it does not reach 90%. 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

Length=15-x, so $A=x(15-x)=-x^2+15x$. Completing the square or symmetry gives maximum at $x=15/2$, with $A=225/4 \text{ cm}^2$. For $x=7$, $A=56$, which is 99.6% of the maximum; therefore it does reach 90%. 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 21

HA21 - Algebraic modelling • Questions 3-4

Q03 | 4 MARKS

Length=18-x, so $A=x(18-x)=-x^2+18x$. Completing the square or symmetry gives maximum at $x=9$, with $A=81 \text{ cm}^2$. For $x=10$, $A=80$, which is 98.8% of the maximum; therefore it does reach 90%. 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

Length=15-x, so $A=x(15-x)=-x^2+15x$. Completing the square or symmetry gives maximum at $x=15/2$, with $A=225/4 \text{ cm}^2$. For $x=5$, $A=50$, which is 88.9% of the maximum; therefore it does not reach 90%. 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 21

HA21 - Algebraic modelling • Questions 5-6

Q05 | 4 MARKS

Length=18-x, so $A=x(18-x)=-x^2+18x$. Completing the square or symmetry gives maximum at $x=9$, with $A=81 \text{ cm}^2$. For $x=8$, $A=80$, which is 98.8% of the maximum; therefore it does reach 90%. 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

Length=15-x, so $A=x(15-x)=-x^2+15x$. Completing the square or symmetry gives maximum at $x=15/2$, with $A=225/4 \text{ cm}^2$. For $x=11$, $A=44$, which is 78.2% of the maximum; therefore it does not reach 90%. 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 21

HA21 - Algebraic modelling • Questions 7-8

Q07 | 4 MARKS

Length=18-x, so $A=x(18-x)=-x^2+18x$. Completing the square or symmetry gives maximum at $x=9$, with $A=81 \text{ cm}^2$. For $x=6$, $A=72$, which is 88.9% of the maximum; therefore it does not reach 90%. 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

Length=15-x, so $A=x(15-x)=-x^2+15x$. Completing the square or symmetry gives maximum at $x=15/2$, with $A=225/4 \text{ cm}^2$. For $x=9$, $A=54$, which is 96.0% of the maximum; therefore it does reach 90%. 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 21

HA21 - Algebraic modelling • Questions 9-10

Q09 | 4 MARKS

Length=18-x, so $A=x(18-x)=-x^2+18x$. Completing the square or symmetry gives maximum at $x=9$, with $A=81 \text{ cm}^2$. For $x=12$, $A=72$, which is 88.9% of the maximum; therefore it does not reach 90%. 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

Length=15-x, so $A=x(15-x)=-x^2+15x$. Completing the square or symmetry gives maximum at $x=15/2$, with $A=225/4 \text{ cm}^2$. For $x=7$, $A=56$, which is 99.6% of the maximum; therefore it does reach 90%. 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 21

HA21 - Algebraic modelling • Questions 11-12

Q11 | 5 MARKS

Length=16-x, so $A=x(16-x)=-x^2+16x$. Completing the square or symmetry gives maximum at $x=8$, with $A=64 \text{ cm}^2$. For $x=8$, $A=64$, which is 100.0% of the maximum; therefore it does reach 90%. 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

Length=17-x, so $A=x(17-x)=-x^2+17x$. Completing the square or symmetry gives maximum at $x=17/2$, with $A=289/4 \text{ cm}^2$. For $x=9$, $A=72$, which is 99.7% of the maximum; therefore it does reach 90%. 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 21 • Completion and retest record

HA21 - Algebraic modelling

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 2 • CHAPTER 22****HA22 - Linear and quadratic inequalities****Chapter purpose**

Solve and represent inequalities using number lines, set notation and graphs.

Higher reasoning expectation

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

Chapter 22 • Method and assessment map

HA22 - Linear and quadratic inequalities

Specification focus

Solve and represent inequalities using number lines, set notation and graphs.

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 22 • Practice

HA22 - Linear and quadratic inequalities • Questions 1-2

Q01 | 4 MARKS

Solve $(x+4)(x-2) \leq 0$. Represent the solution on a number line and list all integer solutions between -10 and 10. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Solve $(x+1)(x-4) \leq 0$. Represent the solution on a number line and list all integer solutions between -10 and 10. Your solution must justify the main method or assumption and include a final check.

Chapter 22 • Practice

HA22 - Linear and quadratic inequalities • Questions 3-4

Q03 | 4 MARKS

Solve $(x+5)(x+1) \leq 0$. Represent the solution on a number line and list all integer solutions between -10 and 10. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Solve $(x+2)(x-1) \leq 0$. Represent the solution on a number line and list all integer solutions between -10 and 10. Your solution must justify the main method or assumption and include a final check.

Chapter 22 • Practice

HA22 - Linear and quadratic inequalities • Questions 5-6

Q05 | 4 MARKS

Solve $(x-1)(x-7) \leq 0$. Represent the solution on a number line and list all integer solutions between -10 and 10. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Solve $(x+3)(x-2) \leq 0$. Represent the solution on a number line and list all integer solutions between -10 and 10. Your solution must justify the main method or assumption and include a final check.

Chapter 22 • Practice

HA22 - Linear and quadratic inequalities • Questions 7-8

Q07 | 4 MARKS

Solve $(x-0)(x-4) \leq 0$. Represent the solution on a number line and list all integer solutions between -10 and 10. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Solve $(x+4)(x+1) \leq 0$. Represent the solution on a number line and list all integer solutions between -10 and 10. Your solution must justify the main method or assumption and include a final check.

Chapter 22 • Practice

HA22 - Linear and quadratic inequalities • Questions 9-10

Q09 | 4 MARKS

Solve $(x+1)(x-5) \leq 0$. Represent the solution on a number line and list all integer solutions between -10 and 10. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

Solve $(x+5)(x-0) \leq 0$. Represent the solution on a number line and list all integer solutions between -10 and 10. Your solution must justify the main method or assumption and include a final check.

Chapter 22 • Practice

HA22 - Linear and quadratic inequalities • Questions 11-12

Q11 | 5 MARKS

You must show your working. Solve $(x+4)(x-2) \leq 0$. Represent the solution on a number line and list all integer solutions between -10 and 10. 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.

Q12 | 6 MARKS

You must show your working. Solve $(x+3)(x-0) \leq 0$. Represent the solution on a number line and list all integer solutions between -10 and 10. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 22

HA22 - Linear and quadratic inequalities • Questions 1-2

Q01 | 4 MARKS

Critical values are -4 and 2. The product is non-positive between the roots, including endpoints, so $-4 \leq x \leq 2$. Required integers: [-4, -3, -2, -1, 0, 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

Critical values are -1 and 4. The product is non-positive between the roots, including endpoints, so $-1 \leq x \leq 4$. Required integers: [-1, 0, 1, 2, 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 Q02.

Worked solutions • Chapter 22

HA22 - Linear and quadratic inequalities • Questions 3-4

Q03 | 4 MARKS

Critical values are -5 and -1. The product is non-positive between the roots, including endpoints, so $-5 \leq x \leq -1$. Required integers: [-5, -4, -3, -2, -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

Critical values are -2 and 1. The product is non-positive between the roots, including endpoints, so $-2 \leq x \leq 1$. Required integers: [-2, -1, 0, 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 22

HA22 - Linear and quadratic inequalities • Questions 5-6

Q05 | 4 MARKS

Critical values are 1 and 7. The product is non-positive between the roots, including endpoints, so $1 \leq x \leq 7$. Required integers: [1, 2, 3, 4, 5, 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 Q05.

Q06 | 4 MARKS

Critical values are -3 and 2. The product is non-positive between the roots, including endpoints, so $-3 \leq x \leq 2$. Required integers: [-3, -2, -1, 0, 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 22

HA22 - Linear and quadratic inequalities • Questions 7-8

Q07 | 4 MARKS

Critical values are 0 and 4. The product is non-positive between the roots, including endpoints, so $0 \leq x \leq 4$. Required integers: [0, 1, 2, 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 Q07.

Q08 | 4 MARKS

Critical values are -4 and -1. The product is non-positive between the roots, including endpoints, so $-4 \leq x \leq -1$. Required integers: [-4, -3, -2, -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 22

HA22 - Linear and quadratic inequalities • Questions 9-10

Q09 | 4 MARKS

Critical values are -1 and 5. The product is non-positive between the roots, including endpoints, so $-1 \leq x \leq 5$. Required integers: [-1, 0, 1, 2, 3, 4, 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 Q09.

Q10 | 4 MARKS

Critical values are -5 and 0. The product is non-positive between the roots, including endpoints, so $-5 \leq x \leq 0$. Required integers: [-5, -4, -3, -2, -1, 0]. 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 22

HA22 - Linear and quadratic inequalities • Questions 11-12

Q11 | 5 MARKS

Critical values are -4 and 2. The product is non-positive between the roots, including endpoints, so $-4 \leq x \leq 2$. Required integers: [-4, -3, -2, -1, 0, 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. 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 Q11.

Q12 | 6 MARKS

Critical values are -3 and 0. The product is non-positive between the roots, including endpoints, so $-3 \leq x \leq 0$. Required integers: [-3, -2, -1, 0]. 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 22 • Completion and retest record

HA22 - Linear and quadratic inequalities

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 2 • CHAPTER 23****HA23 - Generating sequences****Chapter purpose**

Use term-to-term, recurrence and position-to-term rules.

Higher reasoning expectation

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

Questions 9–12 provide the chapter stretch sequence.

Chapter 23 • Method and assessment map

HA23 - Generating sequences

Specification focus

Use term-to-term, recurrence and position-to-term rules.

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 23 • Practice

HA23 - Generating sequences • Questions 1-2

Q01 | 4 MARKS

A quadratic sequence begins [7, 17, 35, 61, 95]. Find its n th term using differences, then determine whether 385 is the 10th term. Generate the required terms from the stated rule before drawing a conclusion. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A quadratic sequence begins [6, 16, 32, 54, 82]. Find its n th term using differences, then determine whether 312 is the 10th term. Generate the required terms from the stated rule before drawing a conclusion. Your solution must justify the main method or assumption and include a final check.

Chapter 23 • Practice

HA23 - Generating sequences • Questions 3-4

Q03 | 4 MARKS

A quadratic sequence begins [4, 7, 14, 25, 40]. Find its n th term using differences, then determine whether 175 is the 10th term. Generate the required terms from the stated rule before drawing a conclusion. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A quadratic sequence begins [3, 6, 11, 18, 27]. Find its n th term using differences, then determine whether 102 is the 10th term. Generate the required terms from the stated rule before drawing a conclusion. Your solution must justify the main method or assumption and include a final check.

Chapter 23 • Practice

HA23 - Generating sequences • Questions 5-6

Q05 | 4 MARKS

A quadratic sequence begins [12, 27, 50, 81, 120]. Find its n th term using differences, then determine whether 435 is the 10th term. Generate the required terms from the stated rule before drawing a conclusion. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A quadratic sequence begins [4, 12, 26, 46, 72]. Find its n th term using differences, then determine whether 292 is the 10th term. Generate the required terms from the stated rule before drawing a conclusion. Your solution must justify the main method or assumption and include a final check.

Chapter 23 • Practice

HA23 - Generating sequences • Questions 7-8

Q07 | 4 MARKS

A quadratic sequence begins [9, 17, 29, 45, 65]. Find its n th term using differences, then determine whether 225 is the 10th term. Generate the required terms from the stated rule before drawing a conclusion. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A quadratic sequence begins [1, 2, 5, 10, 17]. Find its n th term using differences, then determine whether 82 is the 10th term. Generate the required terms from the stated rule before drawing a conclusion.

Chapter 23 • Practice

HA23 - Generating sequences • Questions 9-10

Q09 | 4 MARKS

A quadratic sequence begins [10, 23, 44, 73, 110]. Find its n th term using differences, then determine whether 415 is the 10th term. Generate the required terms from the stated rule before drawing a conclusion. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

A quadratic sequence begins [2, 8, 20, 38, 62]. Find its n th term using differences, then determine whether 272 is the 10th term. Generate the required terms from the stated rule before drawing a conclusion. Your solution must justify the main method or assumption and include a final check.

Chapter 23 • Practice

HA23 - Generating sequences • Questions 11-12

Q11 | 5 MARKS

You must show your working. A quadratic sequence begins [5, 15, 33, 59, 93]. Find its n th term using differences, then determine whether 383 is the 10th term. Generate the required terms from the stated rule before drawing a conclusion. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A quadratic sequence begins [4, 6, 10, 16, 24]. Find its n th term using differences, then determine whether 94 is the 10th term. Generate the required terms from the stated rule before drawing a conclusion. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 23

HA23 - Generating sequences • Questions 1-2

Q01 | 4 MARKS

First differences are [10, 18, 26, 34]; second difference is 8, so the n^2 coefficient is 4. Matching the remaining linear and constant parts gives $4n^2 - 2n + 5$. At $n=10$ this equals 385, so the stated value is the 10th term. The solution must show the generated terms or recurrence steps. 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 differences are [10, 16, 22, 28]; second difference is 6, so the n^2 coefficient is 3. Matching the remaining linear and constant parts gives $3n^2 + 1n + 2$. At $n=10$ this equals 312, so the stated value is the 10th term. The solution must show the generated terms or recurrence steps. 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 23

HA23 - Generating sequences • Questions 3-4

Q03 | 4 MARKS

First differences are [3, 7, 11, 15]; second difference is 4, so the n^2 coefficient is 2. Matching the remaining linear and constant parts gives $2n^2 - 3n + 5$. At $n=10$ this equals 175, so the stated value is the 10th term. The solution must show the generated terms or recurrence steps. 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 differences are [3, 5, 7, 9]; second difference is 2, so the n^2 coefficient is 1. Matching the remaining linear and constant parts gives $1n^2 + 0n + 2$. At $n=10$ this equals 102, so the stated value is the 10th term. The solution must show the generated terms or recurrence steps. 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 23

HA23 - Generating sequences • Questions 5-6

Q05 | 4 MARKS

First differences are [15, 23, 31, 39]; second difference is 8, so the n^2 coefficient is 4. Matching the remaining linear and constant parts gives $4n^2 + 3n + 5$. At $n=10$ this equals 435, so the stated value is the 10th term. The solution must show the generated terms or recurrence steps. 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 differences are [8, 14, 20, 26]; second difference is 6, so the n^2 coefficient is 3. Matching the remaining linear and constant parts gives $3n^2 - 1n + 2$. At $n=10$ this equals 292, so the stated value is the 10th term. The solution must show the generated terms or recurrence steps. 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 23

HA23 - Generating sequences • Questions 7-8

Q07 | 4 MARKS

First differences are [8, 12, 16, 20]; second difference is 4, so the n^2 coefficient is 2. Matching the remaining linear and constant parts gives $2n^2 + 2n + 5$. At $n=10$ this equals 225, so the stated value is the 10th term. The solution must show the generated terms or recurrence steps. 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 differences are [1, 3, 5, 7]; second difference is 2, so the n^2 coefficient is 1. Matching the remaining linear and constant parts gives $1n^2 - 2n + 2$. At $n=10$ this equals 82, so the stated value is the 10th term. The solution must show the generated terms or recurrence steps. 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 23

HA23 - Generating sequences • Questions 9-10

Q09 | 4 MARKS

First differences are [13, 21, 29, 37]; second difference is 8, so the n^2 coefficient is 4. Matching the remaining linear and constant parts gives $4n^2 + 1n + 5$. At $n=10$ this equals 415, so the stated value is the 10th term. The solution must show the generated terms or recurrence steps. 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 differences are [6, 12, 18, 24]; second difference is 6, so the n^2 coefficient is 3. Matching the remaining linear and constant parts gives $3n^2 - 3n + 2$. At $n=10$ this equals 272, so the stated value is the 10th term. The solution must show the generated terms or recurrence steps. 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 23

HA23 - Generating sequences • Questions 11-12

Q11 | 5 MARKS

First differences are [10, 18, 26, 34]; second difference is 8, so the n^2 coefficient is 4. Matching the remaining linear and constant parts gives $4n^2 - 2n + 3$. At $n=10$ this equals 383, so the stated value is the 10th term. The solution must show the generated terms or recurrence steps. 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 differences are [2, 4, 6, 8]; second difference is 2, so the n^2 coefficient is 1. Matching the remaining linear and constant parts gives $1n^2 - 1n + 4$. At $n=10$ this equals 94, so the stated value is the 10th term. The solution must show the generated terms or recurrence steps. 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 23 • Completion and retest record

HA23 - Generating sequences

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 2 • CHAPTER 24****HA24 - Recognising important sequences****Chapter purpose**

Work with arithmetic, geometric, quadratic, Fibonacci-type, square, cube and triangular sequences.

Higher reasoning expectation

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

Questions 9–12 provide the chapter stretch sequence.

Chapter 24 • Method and assessment map

HA24 - Recognising important sequences

Specification focus

Work with arithmetic, geometric, quadratic, Fibonacci-type, square, cube and triangular sequences.

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 24 • Practice

HA24 - Recognising important sequences • Questions 1-2

Q01 | 4 MARKS

A quadratic sequence begins [7, 17, 35, 61, 95]. Find its n th term using differences, then determine whether 385 is the 10th term. Name the sequence type and cite the relevant difference or ratio structure. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A quadratic sequence begins [6, 16, 32, 54, 82]. Find its n th term using differences, then determine whether 312 is the 10th term. Name the sequence type and cite the relevant difference or ratio structure. Your solution must justify the main method or assumption and include a final check.

Chapter 24 • Practice

HA24 - Recognising important sequences • Questions 3-4

Q03 | 4 MARKS

A quadratic sequence begins [4, 7, 14, 25, 40]. Find its n th term using differences, then determine whether 175 is the 10th term. Name the sequence type and cite the relevant difference or ratio structure. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A quadratic sequence begins [3, 6, 11, 18, 27]. Find its n th term using differences, then determine whether 102 is the 10th term. Name the sequence type and cite the relevant difference or ratio structure. Your solution must justify the main method or assumption and include a final check.

Chapter 24 • Practice

HA24 - Recognising important sequences • Questions 5-6

Q05 | 4 MARKS

A quadratic sequence begins [12, 27, 50, 81, 120]. Find its n th term using differences, then determine whether 435 is the 10th term. Name the sequence type and cite the relevant difference or ratio structure. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A quadratic sequence begins [4, 12, 26, 46, 72]. Find its n th term using differences, then determine whether 292 is the 10th term. Name the sequence type and cite the relevant difference or ratio structure. Your solution must justify the main method or assumption and include a final check.

Chapter 24 • Practice

HA24 - Recognising important sequences • Questions 7-8

Q07 | 4 MARKS

A quadratic sequence begins [9, 17, 29, 45, 65]. Find its n th term using differences, then determine whether 225 is the 10th term. Name the sequence type and cite the relevant difference or ratio structure. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A quadratic sequence begins [1, 2, 5, 10, 17]. Find its n th term using differences, then determine whether 82 is the 10th term. Name the sequence type and cite the relevant difference or ratio structure.

Chapter 24 • Practice

HA24 - Recognising important sequences • Questions 9-10

Q09 | 4 MARKS

A quadratic sequence begins [10, 23, 44, 73, 110]. Find its n th term using differences, then determine whether 415 is the 10th term. Name the sequence type and cite the relevant difference or ratio structure. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

A quadratic sequence begins [2, 8, 20, 38, 62]. Find its n th term using differences, then determine whether 272 is the 10th term. Name the sequence type and cite the relevant difference or ratio structure. Your solution must justify the main method or assumption and include a final check.

Chapter 24 • Practice

HA24 - Recognising important sequences • Questions 11-12

Q11 | 5 MARKS

You must show your working. A quadratic sequence begins [5, 15, 33, 59, 93]. Find its n th term using differences, then determine whether 383 is the 10th term. Name the sequence type and cite the relevant difference or ratio structure. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A quadratic sequence begins [4, 6, 10, 16, 24]. Find its n th term using differences, then determine whether 94 is the 10th term. Name the sequence type and cite the relevant difference or ratio structure. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 24

HA24 - Recognising important sequences • Questions 1-2

Q01 | 4 MARKS

First differences are [10, 18, 26, 34]; second difference is 8, so the n^2 coefficient is 4. Matching the remaining linear and constant parts gives $4n^2 - 2n + 5$. At $n=10$ this equals 385, so the stated value is the 10th term. The classification must be supported by first differences, second differences or common ratios. 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 differences are [10, 16, 22, 28]; second difference is 6, so the n^2 coefficient is 3. Matching the remaining linear and constant parts gives $3n^2 + 1n + 2$. At $n=10$ this equals 312, so the stated value is the 10th term. The classification must be supported by first differences, second differences or common ratios. 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 24

HA24 - Recognising important sequences • Questions 3-4

Q03 | 4 MARKS

First differences are [3, 7, 11, 15]; second difference is 4, so the n^2 coefficient is 2. Matching the remaining linear and constant parts gives $2n^2 - 3n + 5$. At $n=10$ this equals 175, so the stated value is the 10th term. The classification must be supported by first differences, second differences or common ratios. 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 differences are [3, 5, 7, 9]; second difference is 2, so the n^2 coefficient is 1. Matching the remaining linear and constant parts gives $1n^2 + 0n + 2$. At $n=10$ this equals 102, so the stated value is the 10th term. The classification must be supported by first differences, second differences or common ratios. 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 24

HA24 - Recognising important sequences • Questions 5-6

Q05 | 4 MARKS

First differences are [15, 23, 31, 39]; second difference is 8, so the n^2 coefficient is 4. Matching the remaining linear and constant parts gives $4n^2 + 3n + 5$. At $n=10$ this equals 435, so the stated value is the 10th term. The classification must be supported by first differences, second differences or common ratios. 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 differences are [8, 14, 20, 26]; second difference is 6, so the n^2 coefficient is 3. Matching the remaining linear and constant parts gives $3n^2 - 1n + 2$. At $n=10$ this equals 292, so the stated value is the 10th term. The classification must be supported by first differences, second differences or common ratios. 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 24

HA24 - Recognising important sequences • Questions 7-8

Q07 | 4 MARKS

First differences are [8, 12, 16, 20]; second difference is 4, so the n^2 coefficient is 2. Matching the remaining linear and constant parts gives $2n^2 + 2n + 5$. At $n=10$ this equals 225, so the stated value is the 10th term. The classification must be supported by first differences, second differences or common ratios. 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 differences are [1, 3, 5, 7]; second difference is 2, so the n^2 coefficient is 1. Matching the remaining linear and constant parts gives $1n^2 - 2n + 2$. At $n=10$ this equals 82, so the stated value is the 10th term. The classification must be supported by first differences, second differences or common ratios. 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 24

HA24 - Recognising important sequences • Questions 9-10

Q09 | 4 MARKS

First differences are [13, 21, 29, 37]; second difference is 8, so the n^2 coefficient is 4. Matching the remaining linear and constant parts gives $4n^2 + 1n + 5$. At $n=10$ this equals 415, so the stated value is the 10th term. The classification must be supported by first differences, second differences or common ratios. 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 differences are [6, 12, 18, 24]; second difference is 6, so the n^2 coefficient is 3. Matching the remaining linear and constant parts gives $3n^2 - 3n + 2$. At $n=10$ this equals 272, so the stated value is the 10th term. The classification must be supported by first differences, second differences or common ratios. 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 24

HA24 - Recognising important sequences • Questions 11-12

Q11 | 5 MARKS

First differences are [10, 18, 26, 34]; second difference is 8, so the n^2 coefficient is 4. Matching the remaining linear and constant parts gives $4n^2 - 2n + 3$. At $n=10$ this equals 383, so the stated value is the 10th term. The classification must be supported by first differences, second differences or common ratios. 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 differences are [2, 4, 6, 8]; second difference is 2, so the n^2 coefficient is 1. Matching the remaining linear and constant parts gives $1n^2 - 1n + 4$. At $n=10$ this equals 94, so the stated value is the 10th term. The classification must be supported by first differences, second differences or common ratios. 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 24 • Completion and retest record

HA24 - Recognising important sequences

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 2 • CHAPTER 25****HA25 - Linear and quadratic nth terms****Chapter purpose**

Derive and use nth-term expressions and prove or disprove membership.

Higher reasoning expectation

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

Chapter 25 • Method and assessment map

HA25 - Linear and quadratic nth terms

Specification focus

Derive and use nth-term expressions and prove or disprove membership.

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 25 • Practice

HA25 - Linear and quadratic nth terms • Questions 1-2

Q01 | 4 MARKS

A quadratic sequence begins [7, 17, 35, 61, 95]. Find its n th term using differences, then determine whether 385 is the 10th term. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A quadratic sequence begins [6, 16, 32, 54, 82]. Find its n th term using differences, then determine whether 312 is the 10th term. Your solution must justify the main method or assumption and include a final check.

Chapter 25 • Practice

HA25 - Linear and quadratic nth terms • Questions 3-4

Q03 | 4 MARKS

A quadratic sequence begins [4, 7, 14, 25, 40]. Find its n th term using differences, then determine whether 175 is the 10th term. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A quadratic sequence begins [3, 6, 11, 18, 27]. Find its n th term using differences, then determine whether 102 is the 10th term. Your solution must justify the main method or assumption and include a final check.

Chapter 25 • Practice

HA25 - Linear and quadratic nth terms • Questions 5-6

Q05 | 4 MARKS

A quadratic sequence begins [12, 27, 50, 81, 120]. Find its n th term using differences, then determine whether 435 is the 10th term. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A quadratic sequence begins [4, 12, 26, 46, 72]. Find its n th term using differences, then determine whether 292 is the 10th term. Your solution must justify the main method or assumption and include a final check.

Chapter 25 • Practice

HA25 - Linear and quadratic nth terms • Questions 7-8

Q07 | 4 MARKS

A quadratic sequence begins [9, 17, 29, 45, 65]. Find its n th term using differences, then determine whether 225 is the 10th term. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A quadratic sequence begins [1, 2, 5, 10, 17]. Find its n th term using differences, then determine whether 82 is the 10th term. Your solution must justify the main method or assumption and include a final check.

Chapter 25 • Practice

HA25 - Linear and quadratic nth terms • Questions 9-10

Q09 | 4 MARKS

A quadratic sequence begins [10, 23, 44, 73, 110]. Find its n th term using differences, then determine whether 415 is the 10th term. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

A quadratic sequence begins [2, 8, 20, 38, 62]. Find its n th term using differences, then determine whether 272 is the 10th term. Your solution must justify the main method or assumption and include a final check.

Chapter 25 • Practice

HA25 - Linear and quadratic nth terms • Questions 11-12

Q11 | 5 MARKS

You must show your working. A quadratic sequence begins [5, 15, 33, 59, 93]. Find its n th term using differences, then determine whether 383 is the 10th term. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A quadratic sequence begins [4, 6, 10, 16, 24]. Find its n th term using differences, then determine whether 94 is the 10th term. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 25

HA25 - Linear and quadratic nth terms • Questions 1-2

Q01 | 4 MARKS

First differences are [10, 18, 26, 34]; second difference is 8, so the n^2 coefficient is 4. Matching the remaining linear and constant parts gives $4n^2 - 2n + 5$. At $n=10$ this equals 385, so the stated value is the 10th term. 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 differences are [10, 16, 22, 28]; second difference is 6, so the n^2 coefficient is 3. Matching the remaining linear and constant parts gives $3n^2 + 1n + 2$. At $n=10$ this equals 312, so the stated value is the 10th term. 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 25

HA25 - Linear and quadratic nth terms • Questions 3-4

Q03 | 4 MARKS

First differences are [3, 7, 11, 15]; second difference is 4, so the n^2 coefficient is 2. Matching the remaining linear and constant parts gives $2n^2 - 3n + 5$. At $n=10$ this equals 175, so the stated value is the 10th term. 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 differences are [3, 5, 7, 9]; second difference is 2, so the n^2 coefficient is 1. Matching the remaining linear and constant parts gives $1n^2 + 0n + 2$. At $n=10$ this equals 102, so the stated value is the 10th term. 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 25

HA25 - Linear and quadratic nth terms • Questions 5-6

Q05 | 4 MARKS

First differences are [15, 23, 31, 39]; second difference is 8, so the n^2 coefficient is 4. Matching the remaining linear and constant parts gives $4n^2 + 3n + 5$. At $n=10$ this equals 435, so the stated value is the 10th term. 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 differences are [8, 14, 20, 26]; second difference is 6, so the n^2 coefficient is 3. Matching the remaining linear and constant parts gives $3n^2 - 1n + 2$. At $n=10$ this equals 292, so the stated value is the 10th term. 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 25

HA25 - Linear and quadratic nth terms • Questions 7-8

Q07 | 4 MARKS

First differences are [8, 12, 16, 20]; second difference is 4, so the n^2 coefficient is 2. Matching the remaining linear and constant parts gives $2n^2 + 2n + 5$. At $n=10$ this equals 225, so the stated value is the 10th term. 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 differences are [1, 3, 5, 7]; second difference is 2, so the n^2 coefficient is 1. Matching the remaining linear and constant parts gives $1n^2 - 2n + 2$. At $n=10$ this equals 82, so the stated value is the 10th term. 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 25

HA25 - Linear and quadratic nth terms • Questions 9-10

Q09 | 4 MARKS

First differences are [13, 21, 29, 37]; second difference is 8, so the n^2 coefficient is 4. Matching the remaining linear and constant parts gives $4n^2 + 1n + 5$. At $n=10$ this equals 415, so the stated value is the 10th term. 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 differences are [6, 12, 18, 24]; second difference is 6, so the n^2 coefficient is 3. Matching the remaining linear and constant parts gives $3n^2 - 3n + 2$. At $n=10$ this equals 272, so the stated value is the 10th term. 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 25

HA25 - Linear and quadratic nth terms • Questions 11-12

Q11 | 5 MARKS

First differences are [10, 18, 26, 34]; second difference is 8, so the n^2 coefficient is 4. Matching the remaining linear and constant parts gives $4n^2 - 2n + 3$. At $n=10$ this equals 383, so the stated value is the 10th term. 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 differences are [2, 4, 6, 8]; second difference is 2, so the n^2 coefficient is 1. Matching the remaining linear and constant parts gives $1n^2 - 1n + 4$. At $n=10$ this equals 94, so the stated value is the 10th term. 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 25 • Completion and retest record

HA25 - Linear and quadratic nth terms

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: _____