

GCSE MATHEMATICS

HIGHER TIER

UNIT 1: NUMBER

CORRECTED PUBLICATION EDITION

16 chapters • 192 questions • 4–6 marks • complete worked solutions

Student: _____

Independent publication notice

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Contents and publication statement

Ch.	Reference and topic
1	HN1 - Ordering real numbers
2	HN2 - Four operations and place value
3	HN3 - Inverse operations and calculation priority
4	HN4 - Prime structure, HCF and LCM
5	HN5 - Systematic listing and the product rule
6	HN6 - Powers, roots and estimation
7	HN7 - Integer and fractional indices
8	HN8 - Exact fractions, surds and multiples of pi
9	HN9 - Standard form
10	HN10 - Terminating and recurring decimals
11	HN11 - Fractions in ratio problems
12	HN12 - Fractions and percentages as operators
13	HN13 - Measures and compound measures
14	HN14 - Estimation and checking
15	HN15 - Rounding and error intervals
16	HN16 - Limits of accuracy and bounds

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 1 • CHAPTER 1****HN1 - Ordering real numbers****Chapter purpose**

Order positive and negative integers, decimals and fractions; use equality and inequality symbols.

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

HN1 - Ordering real numbers

Specification focus

Order positive and negative integers, decimals and fractions; use equality and inequality symbols.

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

HN1 - Ordering real numbers • Questions 1-2

Q01 | 4 MARKS

A bank balance is -£146.80. A payment of £235.50 arrives, three equal bills of £41.75 leave, and a £9.20 fee is charged. Find the balance and interpret its sign. Your solution must justify the main method or assumption and include a final check.

Q02 | 6 MARKS

You must show your working. A game score begins at 40. Correct answers add 7, incorrect answers subtract 4 and omitted answers subtract 1. After 18 questions, 10 were correct and the final score was 91. Find the numbers incorrect and omitted. Your solution must justify the main method or assumption and include a final check.

Chapter 1 • Practice

HN1 - Ordering real numbers • Questions 3-4

Q03 | 5 MARKS

You must show your working. Evaluate $[(-4)^3 - (-2)^5] \div [-3^2 + 5]$. Explain the difference between -3^2 and $(-3)^2$. Your solution must justify the main method or assumption and include a final check.

Q04 | 5 MARKS

You must show your working. Show that $0.58 < \sqrt{1/3} < 0.59$ is false as written, then repair it using two-decimal bounds. Your solution must justify the main method or assumption and include a final check.

Chapter 1 • Practice

HN1 - Ordering real numbers • Questions 5-6

Q05 | 6 MARKS

You must show your working. The four values p , -9 , 14 and $2p$ have range 41 . Find every possible value of p . Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Evaluate $(-1)^{101} + (-1)^{202} - (-2)^4 + -2^4$. Explain each sign before combining. Your solution must justify the main method or assumption and include a final check.

Chapter 1 • Practice

HN1 - Ordering real numbers • Questions 7-8

Q07 | 5 MARKS

You must show your working. A number x is negative and satisfies $x^2 < 30$ and $|x-2| > 6$. Find all possible integer values. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Three consecutive integers have mean -7 . Their squares are then given signs $+$, $-$, $+$ in order. Evaluate the resulting signed sum. Your solution must justify the main method or assumption and include a final check.

Chapter 1 • Practice

HN1 - Ordering real numbers • Questions 9-10

Q09 | 5 MARKS

You must show your working. A student orders $-\sqrt{27}$, -5.18 and $-26/5$ as $-\sqrt{27} < -26/5 < -5.18$. Identify and repair the error exactly.

Q10 | 5 MARKS

You must show your working. Numbers x and y satisfy $x < y < 0$ and $xy = 24$. Decide which of $x+y$, $x-y$ and $y-x$ must be positive, negative or cannot be fixed. Your solution must justify the main method or assumption and include a final check.

Chapter 1 • Practice

HN1 - Ordering real numbers • Questions 11-12

Q11 | 5 MARKS

You must show your working. A quantity changes from -12 to 18, then by -250% of that first change, and finally increases by 45. Find the final value and explain the meaning of the percentage step. Your solution must justify the main method or assumption and include a final check.

Q12 | 5 MARKS

You must show your working. Prove that if $x < y$ then $-3x + 4 > -3y + 4$, and explain geometrically what the transformation does to order.

Worked solutions • Chapter 1

HN1 - Ordering real numbers • Questions 1-2

Q01 | 4 MARKS

Balance = $-146.80 + 235.50 - 3(41.75) - 9.20 = -146.80 + 235.50 - 125.25 - 9.20 = -£45.75$. The negative sign means the account is £45.75 overdrawn. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 6 MARKS

Let i incorrect and o omitted. $i+o=8$. Score equation $40+70-4i-o=91$ gives $4i+o=19$. Subtract $i+o=8$ to get $3i=11$, not an integer. Therefore the stated data are impossible; at least one recorded value is wrong. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN1 - Ordering real numbers • Questions 3-4

Q03 | 5 MARKS

Numerator $= -64 - (-32) = -32$. Denominator $-3^2 + 5 = -9 + 5 = -4$. Quotient $= (-32)/(-4) = 8$. Here -3^2 means $-(3^2)$; brackets would make the base -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 | 5 MARKS

$0.58^2 = 0.3364 > 1/3$, so $\sqrt{1/3} < 0.58$; the lower inequality is false. Also $0.57^2 = 0.3249 < 1/3$. Correct bounds are $0.57 < \sqrt{1/3} < 0.58$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN1 - Ordering real numbers • Questions 5-6

Q05 | 6 MARKS

The extremes depend on p . If $2p$ is maximum and -9 minimum, $2p+9=41$ gives $p=16$, valid. If 14 is maximum and $2p$ minimum, $14-2p=41$ gives $p=-13.5$, but p itself -13.5 is greater than $2p=-27$, valid. Other extreme assignments either contradict ordering or repeat these. Thus $p=16$ or $p=-13.5$. 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 Q05.

Q06 | 4 MARKS

Odd power: $(-1)^{101}=-1$. Even power: $(-1)^{202}=1$. $(-2)^4=16$, while $-2^4=-16$. Expression $=-1+1-16-16=-32$. 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 1

HN1 - Ordering real numbers • Questions 7-8

Q07 | 5 MARKS

$x^2 < 30$ gives $-\sqrt{30} < x < \sqrt{30}$, so integer x is -5 to 5. $|x-2| > 6$ gives $x < -4$ or $x > 8$. With x negative, intersection is $x = -5$. 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

The integers are -8, -7, -6. Signed square sum $= (-8)^2 - (-7)^2 + (-6)^2 = 64 - 49 + 36 = 51$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN1 - Ordering real numbers • Questions 9-10

Q09 | 5 MARKS

$-26/5 = -5.2$. Since $5.2^2 = 27.04 > 27$, we have $5.2 > \sqrt{27}$, so negating gives $-5.2 < -\sqrt{27}$. Also $5.18^2 = 26.8324 < 27$, so $-\sqrt{27} < -5.18$. Correct ascending order is $-26/5$, $-\sqrt{27}$, -5.18 . The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Q10 | 5 MARKS

Both x, y are negative, so $x+y$ is negative. Since $x < y$, $x-y$ is negative and $y-x$ is positive. The product condition confirms neither is zero but is not otherwise needed. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN1 - Ordering real numbers • Questions 11-12

Q11 | 5 MARKS

First change= $18 - (-12) = 30$. A change of -250% of 30 is $-2.5 \times 30 = -75$. From 18: $18 - 75 + 45 = -12$. The percentage is applied to the change of 30, not to the current value. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 5 MARKS

Multiplying $x < y$ by -3 reverses the inequality: $-3x > -3y$. Adding 4 preserves it: $-3x + 4 > -3y + 4$. Geometrically, multiplication by a negative reflects the number line and reverses order; translation by 4 does not change 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 1 • Completion and retest record

HN1 - Ordering real numbers

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 1 • CHAPTER 2****HN2 - Four operations and place value****Chapter purpose**

Apply formal and efficient methods to positive and negative integers, decimals, proper and improper fractions and mixed numbers.

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

HN2 - Four operations and place value

Specification focus

Apply formal and efficient methods to positive and negative integers, decimals, proper and improper fractions and mixed numbers.

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

HN2 - Four operations and place value • Questions 1-2

Q01 | 4 MARKS

Calculate $\frac{4}{7} + \frac{4}{7}$ and $\frac{4}{7} \times \frac{4}{7}$ in simplest form. Then calculate $\frac{4}{7}$ divided by $\frac{4}{7}$ and explain the reciprocal step. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Calculate $\frac{1}{4} + \frac{6}{8}$ and $\frac{1}{4} \times \frac{6}{8}$ in simplest form. Then calculate $\frac{1}{4}$ divided by $\frac{6}{8}$ and explain the reciprocal step. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HN2 - Four operations and place value • Questions 3-4

Q03 | 4 MARKS

Calculate $\frac{4}{7} + \frac{1}{8}$ and $\frac{4}{7} \times \frac{1}{8}$ in simplest form. Then calculate $\frac{4}{7}$ divided by $\frac{1}{8}$ and explain the reciprocal step. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Calculate $\frac{1}{4} + \frac{1}{9}$ and $\frac{1}{4} \times \frac{1}{9}$ in simplest form. Then calculate $\frac{1}{4}$ divided by $\frac{1}{9}$ and explain the reciprocal step. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HN2 - Four operations and place value • Questions 5-6

Q05 | 4 MARKS

Calculate $\frac{4}{7} + \frac{2}{9}$ and $\frac{4}{7} \times \frac{2}{9}$ in simplest form. Then calculate $\frac{4}{7}$ divided by $\frac{2}{9}$ and explain the reciprocal step. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Calculate $\frac{1}{4} + \frac{1}{10}$ and $\frac{1}{4} \times \frac{1}{10}$ in simplest form. Then calculate $\frac{1}{4}$ divided by $\frac{1}{10}$ and explain the reciprocal step. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HN2 - Four operations and place value • Questions 7-8

Q07 | 4 MARKS

Calculate $\frac{4}{7} + \frac{1}{10}$ and $\frac{4}{7} \times \frac{1}{10}$ in simplest form. Then calculate $\frac{4}{7}$ divided by $\frac{1}{10}$ and explain the reciprocal step. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Calculate $\frac{1}{4} + \frac{9}{11}$ and $\frac{1}{4} \times \frac{9}{11}$ in simplest form. Then calculate $\frac{1}{4}$ divided by $\frac{9}{11}$ and explain the reciprocal step. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HN2 - Four operations and place value • Questions 9-10

Q09 | 5 MARKS

You must show your working. Calculate $\frac{4}{7} + \frac{8}{11}$ and $\frac{4}{7} \times \frac{8}{11}$ in simplest form. Then calculate $\frac{4}{7}$ divided by $\frac{8}{11}$ and explain the reciprocal step. Your solution must justify the main method or assumption and include a final check.

Q10 | 5 MARKS

You must show your working. Calculate $\frac{1}{4} + \frac{6}{12}$ and $\frac{1}{4} \times \frac{6}{12}$ in simplest form. Then calculate $\frac{1}{4}$ divided by $\frac{6}{12}$ and explain the reciprocal step. Your solution must justify the main method or assumption and include a final check.

Chapter 2 • Practice

HN2 - Four operations and place value • Questions 11-12

Q11 | 5 MARKS

You must show your working. Calculate $\frac{4}{5} + \frac{9}{12}$ and $\frac{4}{5} \times \frac{9}{12}$ in simplest form. Then calculate $\frac{4}{5}$ divided by $\frac{9}{12}$ and explain the reciprocal step. Your solution must justify the main method or assumption and include a final check.

Q12 | 5 MARKS

You must show your working. Calculate $\frac{5}{6} + \frac{1}{12}$ and $\frac{5}{6} \times \frac{1}{12}$ in simplest form. Then calculate $\frac{5}{6}$ divided by $\frac{1}{12}$ and explain the reciprocal step. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 2

HN2 - Four operations and place value • Questions 1-2

Q01 | 4 MARKS

Common-denominator addition gives $\frac{8}{7}$. Multiplication gives $\frac{16}{49}$. Division means multiply by the reciprocal: $\frac{4}{7} \times \frac{7}{4} = 1$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Q02 | 4 MARKS

Common-denominator addition gives 1. Multiplication gives $\frac{3}{16}$. Division means multiply by the reciprocal: $\frac{1}{4} \times \frac{4}{3} = \frac{1}{3}$. 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 2

HN2 - Four operations and place value • Questions 3-4

Q03 | 4 MARKS

Common-denominator addition gives $\frac{39}{56}$. Multiplication gives $\frac{1}{14}$. Division means multiply by the reciprocal: $\frac{4}{7} \times 8 = \frac{32}{7}$. 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 Q03.

Q04 | 4 MARKS

Common-denominator addition gives $\frac{13}{36}$. Multiplication gives $\frac{1}{36}$. Division means multiply by the reciprocal: $\frac{1}{4} \times 9 = \frac{9}{4}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Worked solutions • Chapter 2

HN2 - Four operations and place value • Questions 5-6

Q05 | 4 MARKS

Common-denominator addition gives $50/63$. Multiplication gives $8/63$. Division means multiply by the reciprocal: $4/7 \times 9/2 = 18/7$. 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

Common-denominator addition gives $7/20$. Multiplication gives $1/40$. Division means multiply by the reciprocal: $1/4 \times 10 = 5/2$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Worked solutions • Chapter 2

HN2 - Four operations and place value • Questions 7-8

Q07 | 4 MARKS

Common-denominator addition gives $47/70$. Multiplication gives $2/35$. Division means multiply by the reciprocal: $4/7 \times 10 = 40/7$. 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

Common-denominator addition gives $47/44$. Multiplication gives $9/44$. Division means multiply by the reciprocal: $1/4 \times 11/9 = 11/36$. 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 Q08.

Worked solutions • Chapter 2

HN2 - Four operations and place value • Questions 9-10

Q09 | 5 MARKS

Common-denominator addition gives $100/77$. Multiplication gives $32/77$. Division means multiply by the reciprocal: $4/7 \times 11/8 = 11/14$. 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 Q09.

Q10 | 5 MARKS

Common-denominator addition gives $3/4$. Multiplication gives $1/8$. Division means multiply by the reciprocal: $1/4 \times 2 = 1/2$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Worked solutions • Chapter 2

HN2 - Four operations and place value • Questions 11-12

Q11 | 5 MARKS

Common-denominator addition gives $\frac{31}{20}$. Multiplication gives $\frac{3}{5}$. Division means multiply by the reciprocal: $\frac{4}{5} \times \frac{4}{3} = \frac{16}{15}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 5 MARKS

Common-denominator addition gives $\frac{11}{12}$. Multiplication gives $\frac{5}{72}$. Division means multiply by the reciprocal: $\frac{5}{6} \times 12 = 10$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Chapter 2 • Completion and retest record

HN2 - Four operations and place value

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 1 • CHAPTER 3****HN3 - Inverse operations and calculation priority****Chapter purpose**

Use inverse relationships, cancellation, brackets, powers, roots and reciprocals to structure exact calculations.

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

HN3 - Inverse operations and calculation priority

Specification focus

Use inverse relationships, cancellation, brackets, powers, roots and reciprocals to structure exact calculations.

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

HN3 - Inverse operations and calculation priority • Questions 1-2

Q01 | 5 MARKS

You must show your working. Solve $(\frac{3}{5})x - \frac{7}{10} = \frac{11}{6}$ exactly. Verify by substitution. Your solution must justify the main method or assumption and include a final check.

Q02 | 5 MARKS

You must show your working. Find the exact value of $(0.6 \text{ recurring} + 0.25) / (1.2 - \frac{5}{8})$. Convert recurring notation before calculating.

Chapter 3 • Practice

HN3 - Inverse operations and calculation priority • Questions 3-4

Q03 | 5 MARKS

You must show your working. A journey is split into $\frac{2}{5}$ at 48 km/h and the remaining $\frac{3}{5}$ at 72 km/h. For a total distance of 180 km, find the exact total travel time. Your solution must justify the main method or assumption and include a final check.

Q04 | 5 MARKS

You must show your working. Evaluate $(\frac{3}{7} \text{ of } \frac{14}{15}) \div (\frac{5}{9} \text{ of } \frac{27}{28})$. Show the meaning of “of” before division. Your solution must justify the main method or assumption and include a final check.

Chapter 3 • Practice

HN3 - Inverse operations and calculation priority • Questions 5-6

Q05 | 5 MARKS

You must show your working. Evaluate exactly: $(11/12 + 3/8) \div (11/12 - 3/8)$. Include a check that the divisor is non-zero. Your solution must justify the main method or assumption and include a final check.

Q06 | 5 MARKS

You must show your working. Evaluate exactly: $(9/10 + 7/25) \div (9/10 - 7/25)$. Include a check that the divisor is non-zero. Your solution must justify the main method or assumption and include a final check.

Chapter 3 • Practice

HN3 - Inverse operations and calculation priority • Questions 7-8

Q07 | 5 MARKS

You must show your working. Evaluate exactly: $(7/16 + 3/20) \div (7/16 - 3/20)$. Include a check that the divisor is non-zero. Your solution must justify the main method or assumption and include a final check.

Q08 | 5 MARKS

You must show your working. Solve $5/(x-1) = 7/3$. State the excluded value and keep the solution exact. Your solution must justify the main method or assumption and include a final check.

Chapter 3 • Practice

HN3 - Inverse operations and calculation priority • Questions 9-10

Q09 | 5 MARKS

You must show your working. Solve $9/(x+5)=3/2$. State the excluded value and keep the solution exact. Your solution must justify the main method or assumption and include a final check.

Q10 | 5 MARKS

You must show your working. A machine completes $5/12$ of a job in $2 \frac{1}{2}$ hours at a constant rate. Find the exact time for the whole job and the time still required. Your solution must justify the main method or assumption and include a final check.

Chapter 3 • Practice

HN3 - Inverse operations and calculation priority • Questions 11-12

Q11 | 6 MARKS

You must show your working. A map scale calculation gives distance $(\frac{7}{8} \times 3\frac{3}{7}) \div (\frac{5}{6})$ centimetres. Evaluate exactly, then convert using 1 cm represents 24 km. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A quantity is multiplied by $\frac{3}{5}$, divided by $\frac{9}{10}$ and then decreased by $\frac{7}{12}$. The result is $\frac{3}{4}$. Find the original quantity. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 3

HN3 - Inverse operations and calculation priority • Questions 1-2

Q01 | 5 MARKS

Add $7/10$: $(3/5)x = 11/6 + 7/10 = 55/30 + 21/30 = 76/30 = 38/15$. Multiply by reciprocal $5/3$: $x = 38/15 \times 5/3 = 38/9$. Substitution gives $38/15 - 7/10 = 76/30 - 21/30 = 55/30 = 11/6$. 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 Q01.

Q02 | 5 MARKS

0.6 recurring $= 2/3$ and $0.25 = 1/4$, so numerator $= 11/12$. Denominator $= 6/5 - 5/8 = 48/40 - 25/40 = 23/40$. Quotient $= 11/12 \times 40/23 = 110/69$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN3 - Inverse operations and calculation priority • Questions 3-4

Q03 | 5 MARKS

Distances are 72 km and 108 km. Times: $72/48=3/2$ h and $108/72=3/2$ h. Total=3 hours. Averaging the two speeds would not generally give the correct time. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

First quantity= $3/7 \times 14/15=2/5$. Second= $5/9 \times 27/28=15/28$. Divide: $2/5 \times 28/15=56/75$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN3 - Inverse operations and calculation priority • Questions 5-6

Q05 | 5 MARKS

The numerator is $31/24$ and the divisor is $13/24$, which is non-zero. Multiply by the reciprocal: $31/24 \div 13/24 = 31/13$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Q06 | 5 MARKS

The numerator is $59/50$ and the divisor is $31/50$, which is non-zero. Multiply by the reciprocal: $59/50 \div 31/50 = 59/31$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN3 - Inverse operations and calculation priority • Questions 7-8

Q07 | 5 MARKS

The numerator is $47/80$ and the divisor is $23/80$, which is non-zero. Multiply by the reciprocal: $47/80 \div 23/80 = 47/23$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Q08 | 5 MARKS

The denominator requires $x \neq 1$. Cross-multiply: $15 = 7(x-1)$. Hence $x-1 = 15/7$, so $x = 22/7$, which 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 3

HN3 - Inverse operations and calculation priority • Questions 9-10

Q09 | 5 MARKS

The denominator requires $x \neq -5$. Cross-multiply: $18 = 3(x+5)$. Hence $x+5=6$, so $x=1$, which 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 | 5 MARKS

Whole time $= (5/2) \div (5/12) = 5/2 \times 12/5 = 6$ hours. Time remaining $= 6 - 5/2 = 7/2$ hours. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN3 - Inverse operations and calculation priority • Questions 11-12

Q11 | 6 MARKS

$3\frac{3}{7} = \frac{24}{7}$. Then $\frac{7}{8} \times \frac{24}{7} = 3$, and $3 \div \frac{5}{6} = \frac{18}{5}$ cm. Real distance $= \frac{18}{5} \times 24 = \frac{432}{5}$ km $= 86.4$ km. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

Let x be original. $(\frac{3}{5})x \div (\frac{9}{10}) = (\frac{3}{5})x \times \frac{10}{9} = \frac{2x}{3}$. So $\frac{2x}{3} - \frac{7}{12} = \frac{3}{4}$. Then $\frac{2x}{3} = \frac{16}{12} = \frac{4}{3}$, giving $x = 2$. 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 Q12.

Chapter 3 • Completion and retest record

HN3 - Inverse operations and calculation priority

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 1 • CHAPTER 4****HN4 - Prime structure, HCF and LCM****Chapter purpose**

Use prime factorisation, product notation and unique factorisation in proof and problem solving.

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

HN4 - Prime structure, HCF and LCM

Specification focus

Use prime factorisation, product notation and unique factorisation in proof and problem solving.

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

HN4 - Prime structure, HCF and LCM • Questions 1-2

Q01 | 6 MARKS

You must show your working. Find the smallest positive integer that leaves remainder 2 when divided by 5, remainder 3 when divided by 7, and is divisible by 4. Your solution must justify the main method or assumption and include a final check.

Q02 | 5 MARKS

You must show your working. A number is written as $2^4 \times 3^3 \times 5$. How many of its positive factors are multiples of 60? Your solution must justify the main method or assumption and include a final check.

Chapter 4 • Practice

HN4 - Prime structure, HCF and LCM • Questions 3-4

Q03 | 5 MARKS

You must show your working. The LCM of $2^a \times 3^2$ and $2^3 \times 3^b$ is $2^5 \times 3^4$, while their HCF is $2^3 \times 3^2$. Find a and b . Your solution must justify the main method or assumption and include a final check.

Q04 | 6 MARKS

You must show your working. The sum of two positive integers is 84 and their HCF is 12. Find all unordered pairs. Your solution must justify the main method or assumption and include a final check.

Chapter 4 • Practice

HN4 - Prime structure, HCF and LCM • Questions 5-6

Q05 | 6 MARKS

You must show your working. A positive integer has exactly three positive factors. Prove that it must be the square of a prime. Your solution must justify the main method or assumption and include a final check.

Q06 | 6 MARKS

You must show your working. Show that the product of four consecutive integers is always divisible by 24. Your solution must justify the main method or assumption and include a final check.

Chapter 4 • Practice

HN4 - Prime structure, HCF and LCM • Questions 7-8

Q07 | 6 MARKS

You must show your working. Find all primes p for which $p+10$ and $p+14$ are also prime. Your solution must justify the main method or assumption and include a final check.

Q08 | 6 MARKS

You must show your working. Two positive integers have product 7560 and HCF 6. Find the pair with the smallest possible difference.

Chapter 4 • Practice

HN4 - Prime structure, HCF and LCM • Questions 9-10

Q09 | 6 MARKS

You must show your working. Find every positive integer n for which $\text{HCF}(n, 84) = 14$ and $\text{LCM}(n, 84) = 420$. Your solution must justify the main method or assumption and include a final check.

Q10 | 6 MARKS

You must show your working. Find the smallest positive integer that is divisible by 45, has exactly 18 positive factors and is not divisible by 8. Your solution must justify the main method or assumption and include a final check.

Chapter 4 • Practice

HN4 - Prime structure, HCF and LCM • Questions 11-12

Q11 | 6 MARKS

You must show your working. Two bells ring together at noon. Their intervals are whole numbers of minutes, have HCF 6 and LCM 180, and one interval is 30 minutes. Find all possible values of the other interval. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. A student claims that every number with exactly 12 factors is divisible by 12. Disprove the claim, then give a 12-factor number that is divisible by 12. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 4

HN4 - Prime structure, HCF and LCM • Questions 1-2

Q01 | 6 MARKS

Multiples of 4 that are 2 mod 5 are 12, 32, 52, 72, 92, ... Check modulo 7: 52 leaves remainder 3. Therefore the smallest is 52. A systematic equivalent is $n = 20k + 12$; solve $20k + 12 \equiv 3 \pmod{7}$, giving $6k \equiv 5$, $k \equiv 2$, hence $n = 52$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 5 MARKS

A factor has form $2^a 3^b 5^c$. To be a multiple of $60 = 2^2 \times 3 \times 5$, require $a = 2, 3, 4$ (3 choices), $b = 1, 2, 3$ (3 choices), $c = 1$ (1 choice). Total $3 \times 3 \times 1 = 9$ factors. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN4 - Prime structure, HCF and LCM • Questions 3-4

Q03 | 5 MARKS

For each prime, the LCM uses the larger exponent and the HCF the smaller. For 2, $\max(a,3)=5$ and $\min(a,3)=3$, so $a=5$. For 3, $\max(2,b)=4$ and $\min(2,b)=2$, so $b=4$. Thus $a=5$, $b=4$. 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 | 6 MARKS

Write the integers as $12a$ and $12b$ with $\text{HCF}(a,b)=1$. Then $a+b=7$. Positive unordered pairs are $(1,6), (2,5), (3,4)$, all coprime. Hence the pairs are $(12,72), (24,60), (36,48)$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Worked solutions • Chapter 4

HN4 - Prime structure, HCF and LCM • Questions 5-6

Q05 | 6 MARKS

If n has exactly three factors, they include 1 and n , with one factor d between. Since d divides n , the paired factor n/d must also be a factor; to avoid a fourth factor it must equal d . Thus $n=d^2$. If d were composite it would contribute another factor of n , so d must be prime. Hence $n=p^2$ for prime p . The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 6 MARKS

Among four consecutive integers there are two even numbers, one of which is divisible by 4; together they supply a factor $2 \times 4 = 8$. Also one of any three consecutive integers is divisible by 3, so the product contains factor 3. Since 8 and 3 are coprime, the product 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 Q06.

Worked solutions • Chapter 4

HN4 - Prime structure, HCF and LCM • Questions 7-8

Q07 | 6 MARKS

Consider modulo 3. The three numbers $p, p+10, p+14$ have residues $p, p+1, p+2$ modulo 3, so one is divisible by 3. For all three to be prime, that divisible number must equal 3. If $p=3$, the numbers are 3, 13, 17, all prime. If $p+10=3$ or $p+14=3$, p is negative. Thus $p=3$ only. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 6 MARKS

Write numbers $6a, 6b$ with $\text{HCF}(a, b)=1$. Then $36ab=7560$, so $ab=210=2 \times 3 \times 5 \times 7$. To keep a, b coprime, allocate whole prime powers between them. Factor pairs closest to $\sqrt{210}$ are 14 and 15, and $\text{HCF}(14, 15)=1$. Thus numbers are 84 and 90, difference 6. Any closer factor pair would contradict 14×15 being the closest around $\sqrt{210}$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN4 - Prime structure, HCF and LCM • Questions 9-10

Q09 | 6 MARKS

Use $n \times 84 = 14 \times 420$, so $n = 70$. Check $70 = 2 \times 5 \times 7$ and $84 = 2^2 \times 3 \times 7$: $\text{HCF} = 2 \times 7 = 14$ and $\text{LCM} = 2^2 \times 3 \times 5 \times 7 = 420$. Therefore $n = 70$ only. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 6 MARKS

Check successive multiples of 45. We have $45 = 3^2 \times 5$ with 6 factors; $90 = 2 \times 3^2 \times 5$ with 12; $135 = 3^3 \times 5$ with 8; and $180 = 2^2 \times 3^2 \times 5$ with $(2+1)(2+1)(1+1) = 18$ factors. Also 180 is not divisible by 8. Therefore the smallest is 180. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN4 - Prime structure, HCF and LCM • Questions 11-12

Q11 | 6 MARKS

Let the other interval be x . From $30x=6 \times 180$, $x=36$. Check $\text{HCF}(30,36)=6$ and $\text{LCM}=180$. Therefore the only possible interval is 36 minutes. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

Counterexample: $32 \times 5 = 160$ has prime form $2^5 \times 5$, so it has $(5+1)(1+1)=12$ factors, but 160 is not divisible by 3 and hence not by 12. Example satisfying the claim: $60=2^2 \times 3 \times 5$ has $3 \times 2 \times 2=12$ factors and 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 Q12.

Chapter 4 • Completion and retest record

HN4 - Prime structure, HCF and LCM

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 1 • CHAPTER 5****HN5 - Systematic listing and the product rule****Chapter purpose**

Construct complete outcome structures and use the product rule for counting.

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

HN5 - Systematic listing and the product rule

Specification focus

Construct complete outcome structures and use the product rule for counting.

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

HN5 - Systematic listing and the product rule • Questions 1-2

Q01 | 6 MARKS

You must show your working. Use digits 1-7 once each to form a seven-digit number. How many arrangements have 1 before 2 before 3, not necessarily adjacent? Your solution must justify the main method or assumption and include a final check.

Q02 | 6 MARKS

You must show your working. Find the number of positive integer solutions to $a+b+c=12$ where $a,b,c \geq 1$. Give a systematic counting argument. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HN5 - Systematic listing and the product rule • Questions 3-4

Q03 | 4 MARKS

A two-digit number is formed from 1,2,3,4,5 without repetition. List systematically those divisible by 3 and count them. Your solution must justify the main method or assumption and include a final check.

Q04 | 6 MARKS

You must show your working. A delivery driver visits four different towns and returns home. Travel must begin at home; reversing a tour counts as the same route. Find the number of distinct tours. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HN5 - Systematic listing and the product rule • Questions 5-6

Q05 | 6 MARKS

You must show your working. A staircase has 8 steps. A person may climb 1 or 2 steps at a time. Count the possible step sequences systematically. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A code uses one of 4 letters followed by two digits chosen from 5 available digits, with repetition allowed. Exactly 3 specified digit-pairs are forbidden. Find the number of valid codes. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HN5 - Systematic listing and the product rule • Questions 7-8

Q07 | 4 MARKS

A code uses one of 3 letters followed by two digits chosen from 8 available digits, with repetition allowed. Exactly 5 specified digit-pairs are forbidden. Find the number of valid codes. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A journey has 4 choices for stage 1, 2 for stage 2 and 6 for stage 3. One complete combination is unavailable for each stage-1 choice. Find the number of valid journeys. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HN5 - Systematic listing and the product rule • Questions 9-10

Q09 | 4 MARKS

A journey has 6 choices for stage 1, 4 for stage 2 and 2 for stage 3. One complete combination is unavailable for each stage-1 choice. Find the number of valid journeys. Your solution must justify the main method or assumption and include a final check.

Q10 | 5 MARKS

You must show your working. Choose 4 people from 10 for an unordered team. Derive the count from an ordered product and explain the division. Your solution must justify the main method or assumption and include a final check.

Chapter 5 • Practice

HN5 - Systematic listing and the product rule • Questions 11-12

Q11 | 5 MARKS

You must show your working. Choose 3 people from 7 for an unordered team. Derive the count from an ordered product and explain the division. Your solution must justify the main method or assumption and include a final check.

Q12 | 5 MARKS

You must show your working. Choose 2 people from 11 for an unordered team. Derive the count from an ordered product and explain the division. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 5

HN5 - Systematic listing and the product rule • Questions 1-2

Q01 | 6 MARKS

There are $7!$ total arrangements. For each placement of the other digits, the six relative orders of 1,2,3 are equally represented, and exactly one is 1 before 2 before 3. $\text{Count} = 7!/3! = 5040/6 = 840$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 6 MARKS

Let $x=a-1, y=b-1, z=c-1$, so $x+y+z=9$ with non-negative integers. Place 9 identical units and 2 separators: choose separator positions among 11, giving $11 \times 10 \div 2 = 55$ solutions. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN5 - Systematic listing and the product rule • Questions 3-4

Q03 | 4 MARKS

Digit sum must be divisible by 3. Valid ordered pairs are from residue-compatible digits: 12,15,21,24,42,45,51,54. There are 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 | 6 MARKS

Arrange four towns in $4!=24$ orders. Each tour and its reverse describe the same undirected cycle from home, so divide by 2: 12 distinct tours. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN5 - Systematic listing and the product rule • Questions 5–6

Q05 | 6 MARKS

Let $f(n)=f(n-1)+f(n-2)$, according to whether the last move is 1 or 2. Starting $f(1)=1, f(2)=2$ gives 3, 5, 8, 13, 21, 34. Therefore $f(8)=34$ sequences. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

Unrestricted codes $= 4 \times 5^2 = 100$. Each forbidden digit-pair combines with any of 4 letters, so exclude $4 \times 3 = 12$. Valid codes $= 88$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN5 - Systematic listing and the product rule • Questions 7–8

Q07 | 4 MARKS

Unrestricted codes = $3 \times 8^2 = 192$. Each forbidden digit-pair combines with any of 3 letters, so exclude $3 \times 5 = 15$. Valid codes = 177. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

Unrestricted journeys = $4 \times 2 \times 6 = 48$. There are 4 unavailable complete combinations, so valid journeys = 44. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN5 - Systematic listing and the product rule • Questions 9-10

Q09 | 4 MARKS

Unrestricted journeys= $6 \times 4 \times 2 = 48$. There are 6 unavailable complete combinations, so valid journeys= 42 . The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Q10 | 5 MARKS

Ordered selections= $10 \times 9 \times 8 \times 7$. Each team is counted $4! = 24$ times through internal orders. Hence the number of teams is 210. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN5 - Systematic listing and the product rule • Questions 11-12

Q11 | 5 MARKS

Ordered selections = $7 \times 6 \times 5$. Each team is counted $3! = 6$ times through internal orders. Hence the number of teams is 35. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 5 MARKS

Ordered selections = 11×10 . Each team is counted $2! = 2$ times through internal orders. Hence the number of teams 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 Q12.

Chapter 5 • Completion and retest record

HN5 - Systematic listing and the product rule

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

Reflection

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

Teacher / reviewer: _____ Date: _____

HIGHER TIER**UNIT 1 • CHAPTER 6****HN6 - Powers, roots and estimation****Chapter purpose**

Recognise powers and estimate powers and roots of positive numbers.

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

HN6 - Powers, roots and estimation

Specification focus

Recognise powers and estimate powers and roots of positive numbers.

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

HN6 - Powers, roots and estimation • Questions 1-2

Q01 | 5 MARKS

You must show your working. Find all integer x satisfying $2^{(x+1)} \leq 64 < 2^{(x+3)}$. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A student concludes that cube root(-64) is undefined because square root(-64) is not real. Correct the argument. Your solution must justify the main method or assumption and include a final check.

Chapter 6 • Practice

HN6 - Powers, roots and estimation • Questions 3-4

Q03 | 5 MARKS

You must show your working. Simplify $(x^6 y^4)^2 \div (x^5 y^{-1})$. Give a single expression with positive indices and state restrictions.

Q04 | 5 MARKS

You must show your working. Simplify $(x^7 y^3)^2 \div (x^6 y^1)$. Give a single expression with positive indices and state restrictions.

Chapter 6 • Practice

HN6 - Powers, roots and estimation • Questions 5-6

Q05 | 5 MARKS

You must show your working. Simplify $(x^3 y^6)^2 \div (x^1 y^5)$. Give a single expression with positive indices and state restrictions.

Q06 | 4 MARKS

Solve $2^{(3x+5)}=2^{13}$, then verify by substitution. Your solution must justify the main method or assumption and include a final check.

Chapter 6 • Practice

HN6 - Powers, roots and estimation • Questions 7-8

Q07 | 4 MARKS

Solve $4^{(2x+2)}=4^{12}$, then verify by substitution. Your solution must justify the main method or assumption and include a final check.

Q08 | 5 MARKS

You must show your working. Prove that $\sqrt{190}$ lies between 13 and 14, then determine the nearer integer without finding the decimal root. Your solution must justify the main method or assumption and include a final check.

Chapter 6 • Practice

HN6 - Powers, roots and estimation • Questions 9-10

Q09 | 5 MARKS

You must show your working. Prove that $\sqrt[3]{680}$ lies between 26 and 27, then determine the nearer integer without finding the decimal root. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

Find the smallest positive integer k such that $5^k > 20000$. Show the two consecutive powers that prove minimality. Your solution must justify the main method or assumption and include a final check.

Chapter 6 • Practice

HN6 - Powers, roots and estimation • Questions 11-12

Q11 | 4 MARKS

Find the smallest positive integer k such that $4^k > 3000$. Show the two consecutive powers that prove minimality. Your solution must justify the main method or assumption and include a final check.

Q12 | 4 MARKS

Find the smallest positive integer k such that $6^k > 100000$. Show the two consecutive powers that prove minimality. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 6

HN6 - Powers, roots and estimation • Questions 1-2

Q01 | 5 MARKS

$64=2^6$. First inequality gives $x+1\leq 6$, so $x\leq 5$. Second gives $6<x+3$, so $x>3$. Thus $x=4$ or 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

Odd roots preserve sign because $(-4)^3=-64$, so cube root $(-64)=-4$. Even roots of negative numbers are not real, but odd roots are real. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN6 - Powers, roots and estimation • Questions 3-4

Q03 | 5 MARKS

Power then subtract divisor exponents: $x^{(6 \times 2 - 5)} = x^7$; $y^{(4 \times 2 - 1)} = y^9$. Rewrite negative exponents as reciprocals. The simplified structure is $x^7 \times y^9$, with $x, y \neq 0$ where required. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

Power then subtract divisor exponents: $x^{(7 \times 2 - 6)} = x^8$; $y^{(3 \times 2 - 1)} = y^5$. Rewrite negative exponents as reciprocals. The simplified structure is $x^8 \times y^5$, with $x, y \neq 0$ where required. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN6 - Powers, roots and estimation • Questions 5-6

Q05 | 5 MARKS

Power then subtract divisor exponents: $x^{(3 \times 2 - 1)} = x^5$; $y^{(6 \times 2 - 5)} = y^7$. Rewrite negative exponents as reciprocals. The simplified structure is $x^5 \times y^7$, with $x, y \neq 0$ where required. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

Equal powers with common base 2 give $3x + 5 = 13$. Hence $x = 8/3$. Substitution makes both exponents 13. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN6 - Powers, roots and estimation • Questions 7-8

Q07 | 4 MARKS

Equal powers with common base 4 give $2x+2=12$. Hence $x=5$. Substitution makes both exponents 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 | 5 MARKS

$13^2=169<190<196=14^2$. The midpoint is 13.5; its square is 182.25. Since 190 is above this midpoint square, the root is closer to 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 Q08.

Worked solutions • Chapter 6

HN6 - Powers, roots and estimation • Questions 9-10

Q09 | 5 MARKS

$26^2 = 676 < 680 < 729 = 27^2$. The midpoint is 26.5; its square is 702.25. Since 680 is below this midpoint square, the root is closer to 26. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

$5^6 = 15625 \leq 20000$, while $5^7 = 78125 > 20000$. Therefore the smallest value is $k=7$. 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 Q10.

Worked solutions • Chapter 6

HN6 - Powers, roots and estimation • Questions 11-12

Q11 | 4 MARKS

$4^5 = 1024 \leq 3000$, while $4^6 = 4096 > 3000$. Therefore the smallest value is $k=6$. 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 Q11.

Q12 | 4 MARKS

$6^6 = 46656 \leq 100000$, while $6^7 = 279936 > 100000$. Therefore the smallest value is $k=7$. 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 6 • Completion and retest record

HN6 - Powers, roots and estimation

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 1 • CHAPTER 7****HN7 - Integer and fractional indices****Chapter purpose**

Calculate with roots and integer, negative and fractional indices.

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

HN7 - Integer and fractional indices

Specification focus

Calculate with roots and integer, negative and fractional indices.

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

HN7 - Integer and fractional indices • Questions 1-2

Q01 | 4 MARKS

Evaluate $4^{(5/2)}$ and $4^{(-5/2)}$ exactly. Verify by identifying the 2th root first. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Evaluate $25^{(3/2)}$ and $25^{(-3/2)}$ exactly. Verify by identifying the 2th root first. Your solution must justify the main method or assumption and include a final check.

Chapter 7 • Practice

HN7 - Integer and fractional indices • Questions 3-4

Q03 | 4 MARKS

Evaluate $64^{(3/2)}$ and $64^{(-3/2)}$ exactly. Verify by identifying the 2th root first. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Evaluate $1331^{(2/3)}$ and $1331^{(-2/3)}$ exactly. Verify by identifying the 3th root first. Your solution must justify the main method or assumption and include a final check.

Chapter 7 • Practice

HN7 - Integer and fractional indices • Questions 5-6

Q05 | 4 MARKS

Evaluate $125^{(4/3)}$ and $125^{(-4/3)}$ exactly. Verify by identifying the 3th root first. Your solution must justify the main method or assumption and include a final check.

Q06 | 5 MARKS

You must show your working. Simplify $z^{(7/4)} \times z^{(3/4)} \div z^{(1/2)}$ as one power. Show the exact fraction arithmetic and state restrictions.

Chapter 7 • Practice

HN7 - Integer and fractional indices • Questions 7-8

Q07 | 5 MARKS

You must show your working. Simplify $z^{(9/5)} \times z^{(-4/5)} \div z^{(2/5)}$ as one power. Show the exact fraction arithmetic and state restrictions.

Q08 | 5 MARKS

You must show your working. Simplify $z^{(15/10)} \times z^{(-3/10)} \div z^{(1/5)}$ as one power. Show the exact fraction arithmetic and state restrictions. Your solution must justify the main method or assumption and include a final check.

Chapter 7 • Practice

HN7 - Integer and fractional indices • Questions 9-10

Q09 | 5 MARKS

You must show your working. Simplify $z^{(19/15)} \times z^{(4/15)} \div z^{(2/5)}$ as one power. Show the exact fraction arithmetic and state restrictions.

Q10 | 5 MARKS

You must show your working. Solve $32^{(x/5)} = 8$ using a common integer base, then verify. Your solution must justify the main method or assumption and include a final check.

Chapter 7 • Practice

HN7 - Integer and fractional indices • Questions 11-12

Q11 | 5 MARKS

You must show your working. Solve $81^{(x/4)}=3$ using a common integer base, then verify. Your solution must justify the main method or assumption and include a final check.

Q12 | 5 MARKS

You must show your working. Solve $125^{(x/3)}=25$ using a common integer base, then verify. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 7

HN7 - Integer and fractional indices • Questions 1-2

Q01 | 4 MARKS

The 2th root of 4 is 2. Raising to power 5 gives $2^5=32$. The negative-index value is its reciprocal, $1/32$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Q02 | 4 MARKS

The 2th root of 25 is 5. Raising to power 3 gives $5^3=125$. The negative-index value is its reciprocal, $1/125$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN7 - Integer and fractional indices • Questions 3-4

Q03 | 4 MARKS

The 2th root of 64 is 8. Raising to power 3 gives $8^3=512$. The negative-index value is its reciprocal, $1/512$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 3th root of 1331 is 11. Raising to power 2 gives $11^2=121$. The negative-index value is its reciprocal, $1/121$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN7 - Integer and fractional indices • Questions 5-6

Q05 | 4 MARKS

The 3th root of 125 is 5. Raising to power 4 gives $5^4=625$. The negative-index value is its reciprocal, $1/625$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Q06 | 5 MARKS

Combined exponent= $7/4+(3/4)-1/2=2$. Therefore the expression is z^2 ; division and any negative powers require $z \neq 0$. 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 Q06.

Worked solutions • Chapter 7

HN7 - Integer and fractional indices • Questions 7-8

Q07 | 5 MARKS

Combined exponent= $9/5+(-4/5)-2/5=3/5$. Therefore the expression is $z^{(3/5)}$; division and any negative powers require $z \neq 0$. 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 Q07.

Q08 | 5 MARKS

Combined exponent= $15/10+(-3/10)-1/5=1$. Therefore the expression is $z^{(1)}$; division and any negative powers require $z \neq 0$. 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 Q08.

Worked solutions • Chapter 7

HN7 - Integer and fractional indices • Questions 9-10

Q09 | 5 MARKS

Combined exponent= $19/15+(4/15)-2/5=17/15$. Therefore the expression is $z^{(17/15)}$; division and any negative powers require $z \neq 0$. 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 Q09.

Q10 | 5 MARKS

The 5th root of 32 is 2, so the left side is 2^x . Since $8=2^3$, $x=3$. Direct substitution verifies the equality. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN7 - Integer and fractional indices • Questions 11-12

Q11 | 5 MARKS

The 4th root of 81 is 3, so the left side is 3^x . Since $3=3^1$, $x=1$. Direct substitution verifies the equality. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 5 MARKS

The 3th root of 125 is 5, so the left side is 5^x . Since $25=5^2$, $x=2$. Direct substitution verifies the equality. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN7 - Integer and fractional indices

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 1 • CHAPTER 8****HN8 - Exact fractions, surds and multiples of π** **Chapter purpose**

Calculate exactly, simplify surds and rationalise denominators.

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

HN8 - Exact fractions, surds and multiples of π

Specification focus

Calculate exactly, simplify surds and rationalise denominators.

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

HN8 - Exact fractions, surds and multiples of pi • Questions 1-2

Q01 | 4 MARKS

Without a calculator, determine which is greater: $5\sqrt{3}$ or $3\sqrt{8}$. Justify a comparison of squares.

Q02 | 4 MARKS

A rectangle has length $4+\sqrt{3}$ cm and width $4-\sqrt{3}$ cm. Find its exact area and explain why it is rational.

Chapter 8 • Practice

HN8 - Exact fractions, surds and multiples of pi • Questions 3-4

Q03 | 4 MARKS

Simplify $4\sqrt{(20)} - 2\sqrt{(5)}$ completely, showing the square factor used. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Simplify $5\sqrt{(63)} - 3\sqrt{(7)}$ completely, showing the square factor used. Your solution must justify the main method or assumption and include a final check.

Chapter 8 • Practice

HN8 - Exact fractions, surds and multiples of pi • Questions 5-6

Q05 | 4 MARKS

Simplify $4\sqrt{75}-1\sqrt{3}$ completely, showing the square factor used. Your solution must justify the main method or assumption and include a final check.

Q06 | 5 MARKS

You must show your working. Expand and simplify $(2+\sqrt{3})(5-\sqrt{3})$. Give an exact answer. Your solution must justify the main method or assumption and include a final check.

Chapter 8 • Practice

HN8 - Exact fractions, surds and multiples of pi • Questions 7-8

Q07 | 5 MARKS

You must show your working. Expand and simplify $(5+\sqrt{6})(4-\sqrt{6})$. Give an exact answer. Your solution must justify the main method or assumption and include a final check.

Q08 | 5 MARKS

You must show your working. Expand and simplify $(7+\sqrt{2})(5-\sqrt{2})$. Give an exact answer. Your solution must justify the main method or assumption and include a final check.

Chapter 8 • Practice

HN8 - Exact fractions, surds and multiples of pi • Questions 9-10

Q09 | 5 MARKS

You must show your working. Expand and simplify $(5+\sqrt{7})(3-\sqrt{7})$. Give an exact answer. Your solution must justify the main method or assumption and include a final check.

Q10 | 5 MARKS

You must show your working. Rationalise $6/(5+\sqrt{7})$ and give the exact result. Your solution must justify the main method or assumption and include a final check.

Chapter 8 • Practice

HN8 - Exact fractions, surds and multiples of pi • Questions 11-12

Q11 | 5 MARKS

You must show your working. Rationalise $\frac{9}{2+\sqrt{3}}$ and give the exact result. Your solution must justify the main method or assumption and include a final check.

Q12 | 5 MARKS

You must show your working. Rationalise $\frac{8}{5+\sqrt{17}}$ and give the exact result. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 8

HN8 - Exact fractions, surds and multiples of pi • Questions 1-2

Q01 | 4 MARKS

Both are positive, so squaring preserves order. $(5\sqrt{3})^2=75$ and $(3\sqrt{8})^2=72$. Hence $5\sqrt{3}>3\sqrt{8}$. 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 Q01.

Q02 | 4 MARKS

$\text{Area}=(4+\sqrt{3})(4-\sqrt{3})=16-3=13 \text{ cm}^2$. Conjugate factors cancel the surd cross-terms. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN8 - Exact fractions, surds and multiples of pi • Questions 3-4

Q03 | 4 MARKS

$\sqrt{20} = \sqrt{4 \times 5} = 2\sqrt{5}$. Therefore the expression is $(4 \times 2 - 2)\sqrt{5} = 6\sqrt{5}$. 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 Q03.

Q04 | 4 MARKS

$\sqrt{63} = \sqrt{9 \times 7} = 3\sqrt{7}$. Therefore the expression is $(5 \times 3 - 3)\sqrt{7} = 12\sqrt{7}$. 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 Q04.

Worked solutions • Chapter 8

HN8 - Exact fractions, surds and multiples of pi • Questions 5–6

Q05 | 4 MARKS

$\sqrt{75} = \sqrt{25 \times 3} = 5\sqrt{3}$. Therefore the expression is $(4 \times 5 - 1)\sqrt{3} = 19\sqrt{3}$. 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 Q05.

Q06 | 5 MARKS

Expansion gives $10 - 2\sqrt{3} + 5\sqrt{3} - 3$. Collecting terms gives $7 + 3\sqrt{3}$. 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 Q06.

Worked solutions • Chapter 8

HN8 - Exact fractions, surds and multiples of pi • Questions 7–8

Q07 | 5 MARKS

Expansion gives $20 - 5\sqrt{6} + 4\sqrt{6} - 6$. Collecting terms gives $14 - \sqrt{6}$. 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 Q07.

Q08 | 5 MARKS

Expansion gives $35 - 7\sqrt{2} + 5\sqrt{2} - 2$. Collecting terms gives $33 - 2\sqrt{2}$. 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 Q08.

Worked solutions • Chapter 8

HN8 - Exact fractions, surds and multiples of pi • Questions 9-10

Q09 | 5 MARKS

Expansion gives $15-5\sqrt{7}+3\sqrt{7}-7$. Collecting terms gives $8-2\sqrt{7}$. 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 Q09.

Q10 | 5 MARKS

Multiply by the conjugate $5-\sqrt{7}$. The denominator is $25-7=18$. Cancelling the common factor 6 gives $(5-\sqrt{7})/3$. 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 8

HN8 - Exact fractions, surds and multiples of pi • Questions 11-12

Q11 | 5 MARKS

Multiply by the conjugate $2-\sqrt{3}$. The denominator is $4-3=1$. No numerical cancellation is available, giving $9(2-\sqrt{3})$. 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 | 5 MARKS

Multiply by the conjugate $5-\sqrt{17}$. The denominator is $25-17=8$. Cancelling the common factor 8 gives $(5-\sqrt{17})$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Chapter 8 • Completion and retest record

HN8 - Exact fractions, surds and multiples of π

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 1 • CHAPTER 9****HN9 - Standard form****Chapter purpose**

Interpret and calculate with $A \times 10^n$, maintaining $1 \leq A < 10$.

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

HN9 - Standard form

Specification focus

Interpret and calculate with $A \times 10^n$, maintaining $1 \leq A < 10$.

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

HN9 - Standard form • Questions 1-2

Q01 | 4 MARKS

Write 1.9×10^6 in standard form. Calculate $(1.9 \times 10^6) \times (2 \times 10^1)$ and give the answer in standard form, explaining how the coefficient is normalised. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Write 1400 in standard form. Calculate $(1.4 \times 10^3) \times (5 \times 10^1)$ and give the answer in standard form, explaining how the coefficient is normalised. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HN9 - Standard form • Questions 3-4

Q03 | 4 MARKS

Write $1.7\text{e}+06$ in standard form. Calculate $(1.7 \times 10^6) \times (3 \times 10^1)$ and give the answer in standard form, explaining how the coefficient is normalised. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Write 1200 in standard form. Calculate $(1.2 \times 10^3) \times (6 \times 10^1)$ and give the answer in standard form, explaining how the coefficient is normalised. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HN9 - Standard form • Questions 5-6

Q05 | 4 MARKS

Write 1.5×10^6 in standard form. Calculate $(1.5 \times 10^6) \times (4 \times 10^1)$ and give the answer in standard form, explaining how the coefficient is normalised. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Write 1800 in standard form. Calculate $(1.8 \times 10^3) \times (2 \times 10^1)$ and give the answer in standard form, explaining how the coefficient is normalised. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HN9 - Standard form • Questions 7-8

Q07 | 4 MARKS

Write $1.3\text{e}+06$ in standard form. Calculate $(1.3 \times 10^6) \times (5 \times 10^1)$ and give the answer in standard form, explaining how the coefficient is normalised. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Write 1600 in standard form. Calculate $(1.6 \times 10^3) \times (3 \times 10^1)$ and give the answer in standard form, explaining how the coefficient is normalised. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HN9 - Standard form • Questions 9-10

Q09 | 5 MARKS

You must show your working. Write 1.9×10^6 in standard form. Calculate $(1.9 \times 10^6) \times (6 \times 10^1)$ and give the answer in standard form, explaining how the coefficient is normalised. Your solution must justify the main method or assumption and include a final check.

Q10 | 5 MARKS

You must show your working. Write 1400 in standard form. Calculate $(1.4 \times 10^3) \times (4 \times 10^1)$ and give the answer in standard form, explaining how the coefficient is normalised. Your solution must justify the main method or assumption and include a final check.

Chapter 9 • Practice

HN9 - Standard form • Questions 11-12

Q11 | 5 MARKS

You must show your working. Write 15000 in standard form. Calculate $(1.5 \times 10^4) \times (5 \times 10^2)$ and give the answer in standard form, explaining how the coefficient is normalised. Your solution must justify the main method or assumption and include a final check.

Q12 | 5 MARKS

You must show your working. Write 160000 in standard form. Calculate $(1.6 \times 10^5) \times (6 \times 10^3)$ and give the answer in standard form, explaining how the coefficient is normalised. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 9

HN9 - Standard form • Questions 1-2

Q01 | 4 MARKS

$1.9\text{e}+06 = 1.9 \times 10^6$. Multiply coefficients and add powers, then move the decimal if the coefficient is at least 10. The normalised result is 3.8×10^7 , with $1 \leq \text{coefficient} < 10$. 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

$1400 = 1.4 \times 10^3$. Multiply coefficients and add powers, then move the decimal if the coefficient is at least 10. The normalised result is 7×10^4 , with $1 \leq \text{coefficient} < 10$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Worked solutions • Chapter 9

HN9 - Standard form • Questions 3–4

Q03 | 4 MARKS

$1.7\text{e}+06 = 1.7 \times 10^6$. Multiply coefficients and add powers, then move the decimal if the coefficient is at least 10. The normalised result is 5.1×10^7 , with $1 \leq \text{coefficient} < 10$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Q04 | 4 MARKS

$1200 = 1.2 \times 10^3$. Multiply coefficients and add powers, then move the decimal if the coefficient is at least 10. The normalised result is 7.2×10^4 , with $1 \leq \text{coefficient} < 10$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Worked solutions • Chapter 9

HN9 - Standard form • Questions 5–6

Q05 | 4 MARKS

$1.5\text{e}+06=1.5\times 10^6$. Multiply coefficients and add powers, then move the decimal if the coefficient is at least 10. The normalised result is 6×10^7 , with $1\leq\text{coefficient}<10$. 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 Q05.

Q06 | 4 MARKS

$1800=1.8\times 10^3$. Multiply coefficients and add powers, then move the decimal if the coefficient is at least 10. The normalised result is 3.6×10^4 , with $1\leq\text{coefficient}<10$. 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 Q06.

Worked solutions • Chapter 9

HN9 - Standard form • Questions 7-8

Q07 | 4 MARKS

$1.3e+06 = 1.3 \times 10^6$. Multiply coefficients and add powers, then move the decimal if the coefficient is at least 10. The normalised result is 6.5×10^7 , with $1 \leq \text{coefficient} < 10$. 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 Q07.

Q08 | 4 MARKS

$1600 = 1.6 \times 10^3$. Multiply coefficients and add powers, then move the decimal if the coefficient is at least 10. The normalised result is 4.8×10^4 , with $1 \leq \text{coefficient} < 10$. 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 Q08.

Worked solutions • Chapter 9

HN9 - Standard form • Questions 9-10

Q09 | 5 MARKS

$1.9\text{e}+06 = 1.9 \times 10^6$. Multiply coefficients and add powers, then move the decimal if the coefficient is at least 10. The normalised result is 1.14×10^8 , with $1 \leq \text{coefficient} < 10$. 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 | 5 MARKS

$1400 = 1.4 \times 10^3$. Multiply coefficients and add powers, then move the decimal if the coefficient is at least 10. The normalised result is 5.6×10^4 , with $1 \leq \text{coefficient} < 10$. 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 Q10.

Worked solutions • Chapter 9

HN9 - Standard form • Questions 11-12

Q11 | 5 MARKS

$15000 = 1.5 \times 10^4$. Multiply coefficients and add powers, then move the decimal if the coefficient is at least 10. The normalised result is 7.5×10^6 , with $1 \leq \text{coefficient} < 10$. 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 Q11.

Q12 | 5 MARKS

$160000 = 1.6 \times 10^5$. Multiply coefficients and add powers, then move the decimal if the coefficient is at least 10. The normalised result is 9.6×10^8 , with $1 \leq \text{coefficient} < 10$. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Chapter 9 • Completion and retest record

HN9 - Standard form

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 1 • CHAPTER 10****HN10 - Terminating and recurring decimals****Chapter purpose**

Move between fractions and decimals and prove recurring-decimal conversions algebraically.

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

HN10 - Terminating and recurring decimals

Specification focus

Move between fractions and decimals and prove recurring-decimal conversions algebraically.

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

HN10 - Terminating and recurring decimals • Questions 1-2

Q01 | 4 MARKS

Let $x=0.8444\ldots$. Use an algebraic subtraction method to write x as a fraction, then verify the decimal pattern. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Let $x=0.3333\ldots$. Use an algebraic subtraction method to write x as a fraction, then verify the decimal pattern. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HN10 - Terminating and recurring decimals • Questions 3-4

Q03 | 4 MARKS

Let $x=0.6222\ldots$. Use an algebraic subtraction method to write x as a fraction, then verify the decimal pattern. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Let $x=0.1888\ldots$. Use an algebraic subtraction method to write x as a fraction, then verify the decimal pattern. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HN10 - Terminating and recurring decimals • Questions 5-6

Q05 | 4 MARKS

Let $x=0.4777\ldots$. Use an algebraic subtraction method to write x as a fraction, then verify the decimal pattern. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Let $x=0.7666\ldots$. Use an algebraic subtraction method to write x as a fraction, then verify the decimal pattern. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HN10 - Terminating and recurring decimals • Questions 7-8

Q07 | 4 MARKS

Let $x=0.2555\ldots$. Use an algebraic subtraction method to write x as a fraction, then verify the decimal pattern. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Let $x=0.5444\ldots$. Use an algebraic subtraction method to write x as a fraction, then verify the decimal pattern. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HN10 - Terminating and recurring decimals • Questions 9-10

Q09 | 4 MARKS

Let $x=0.8333\ldots$. Use an algebraic subtraction method to write x as a fraction, then verify the decimal pattern. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

Let $x=0.3222\ldots$. Use an algebraic subtraction method to write x as a fraction, then verify the decimal pattern. Your solution must justify the main method or assumption and include a final check.

Chapter 10 • Practice

HN10 - Terminating and recurring decimals • Questions 11-12

Q11 | 5 MARKS

You must show your working. Let $x=0.4444\ldots$. Use an algebraic subtraction method to write x as a fraction, then verify the decimal pattern. Your solution must justify the main method or assumption and include a final check.

Q12 | 6 MARKS

You must show your working. Let $x=0.5666\ldots$. Use an algebraic subtraction method to write x as a fraction, then verify the decimal pattern. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 10

HN10 - Terminating and recurring decimals • Questions 1-2

Q01 | 4 MARKS

$10x=8.444\dots$ and $100x=84.444\dots$. Subtract: $90x=76$, so $x=38/45$. Division reproduces the stated recurring decimal. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

$10x=3.333\dots$ and $100x=33.333\dots$. Subtract: $90x=30$, so $x=1/3$. Division reproduces the stated recurring decimal. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN10 - Terminating and recurring decimals • Questions 3-4

Q03 | 4 MARKS

$10x=6.222\ldots$ and $100x=62.222\ldots$. Subtract: $90x=56$, so $x=28/45$. Division reproduces the stated recurring decimal. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

$10x=1.888\ldots$ and $100x=18.888\ldots$. Subtract: $90x=17$, so $x=17/90$. Division reproduces the stated recurring decimal. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN10 - Terminating and recurring decimals • Questions 5-6

Q05 | 4 MARKS

$10x=4.777\dots$ and $100x=47.777\dots$. Subtract: $90x=43$, so $x=43/90$. Division reproduces the stated recurring decimal. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

$10x=7.666\dots$ and $100x=76.666\dots$. Subtract: $90x=69$, so $x=23/30$. Division reproduces the stated recurring decimal. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN10 - Terminating and recurring decimals • Questions 7-8

Q07 | 4 MARKS

$10x=2.555\dots$ and $100x=25.555\dots$. Subtract: $90x=23$, so $x=23/90$. Division reproduces the stated recurring decimal. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

$10x=5.444\dots$ and $100x=54.444\dots$. Subtract: $90x=49$, so $x=49/90$. Division reproduces the stated recurring decimal. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN10 - Terminating and recurring decimals • Questions 9-10

Q09 | 4 MARKS

$10x=8.333\dots$ and $100x=83.333\dots$. Subtract: $90x=75$, so $x=5/6$. Division reproduces the stated recurring decimal. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

$10x=3.222\dots$ and $100x=32.222\dots$. Subtract: $90x=29$, so $x=29/90$. Division reproduces the stated recurring decimal. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN10 - Terminating and recurring decimals • Questions 11-12

Q11 | 5 MARKS

$10x = 4.444\ldots$ and $100x = 44.444\ldots$. Subtract: $90x = 40$, so $x = 4/9$. Division reproduces the stated recurring decimal. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

$10x = 5.666\ldots$ and $100x = 56.666\ldots$. Subtract: $90x = 51$, so $x = 17/30$. Division reproduces the stated recurring decimal. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN10 - Terminating and recurring decimals

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 1 • CHAPTER 11****HN11 - Fractions in ratio problems****Chapter purpose**

Use part-whole and multiplicative fraction relationships inside linked ratio problems.

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

HN11 - Fractions in ratio problems

Specification focus

Use part-whole and multiplicative fraction relationships inside linked ratio problems.

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

HN11 - Fractions in ratio problems • Questions 1-2

Q01 | 4 MARKS

$\frac{4}{6}$ of a fund of GBP 480 is reserved. The remainder is shared in the ratio 2:6. Find all three amounts and express the second share as a fraction of the whole fund. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

$\frac{5}{9}$ of a fund of GBP 720 is reserved. The remainder is shared in the ratio 5:3. Find all three amounts and express the second share as a fraction of the whole fund. Your solution must justify the main method or assumption and include a final check.

Chapter 11 • Practice

HN11 - Fractions in ratio problems • Questions 3-4

Q03 | 4 MARKS

$\frac{1}{5}$ of a fund of GBP 450 is reserved. The remainder is shared in the ratio 3:6. Find all three amounts and express the second share as a fraction of the whole fund. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

$\frac{1}{8}$ of a fund of GBP 720 is reserved. The remainder is shared in the ratio 6:3. Find all three amounts and express the second share as a fraction of the whole fund. Your solution must justify the main method or assumption and include a final check.

Chapter 11 • Practice

HN11 - Fractions in ratio problems • Questions 5-6

Q05 | 4 MARKS

$\frac{1}{11}$ of a fund of GBP 1100 is reserved. The remainder is shared in the ratio 4:6. Find all three amounts and express the second share as a fraction of the whole fund. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

$\frac{1}{7}$ of a fund of GBP 350 is reserved. The remainder is shared in the ratio 2:3. Find all three amounts and express the second share as a fraction of the whole fund. Your solution must justify the main method or assumption and include a final check.

Chapter 11 • Practice

HN11 - Fractions in ratio problems • Questions 7-8

Q07 | 4 MARKS

$\frac{2}{10}$ of a fund of GBP 1100 is reserved. The remainder is shared in the ratio 5:6. Find all three amounts and express the second share as a fraction of the whole fund. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

$\frac{1}{6}$ of a fund of GBP 360 is reserved. The remainder is shared in the ratio 3:3. Find all three amounts and express the second share as a fraction of the whole fund. Your solution must justify the main method or assumption and include a final check.

Chapter 11 • Practice

HN11 - Fractions in ratio problems • Questions 9-10

Q09 | 5 MARKS

You must show your working. $\frac{5}{9}$ of a fund of GBP 1080 is reserved. The remainder is shared in the ratio 6:6. Find all three amounts and express the second share as a fraction of the whole fund. Your solution must justify the main method or assumption and include a final check.

Q10 | 5 MARKS

You must show your working. $\frac{1}{5}$ of a fund of GBP 350 is reserved. The remainder is shared in the ratio 4:3. Find all three amounts and express the second share as a fraction of the whole fund. Your solution must justify the main method or assumption and include a final check.

Chapter 11 • Practice

HN11 - Fractions in ratio problems • Questions 11-12

Q11 | 5 MARKS

You must show your working. $\frac{4}{6}$ of a fund of GBP 540 is reserved. The remainder is shared in the ratio 5:4. Find all three amounts and express the second share as a fraction of the whole fund. Your solution must justify the main method or assumption and include a final check.

Q12 | 5 MARKS

You must show your working. $\frac{5}{7}$ of a fund of GBP 770 is reserved. The remainder is shared in the ratio 6:5. Find all three amounts and express the second share as a fraction of the whole fund. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 11

HN11 - Fractions in ratio problems • Questions 1-2

Q01 | 4 MARKS

Reserved amount = $\frac{4}{6} \times 480 = \text{GBP } 320$. Remainder = GBP 160. One ratio part = $160 / (8) = \text{GBP } 20$. Shares are GBP 40 and GBP 120; the second is $\frac{1}{4}$ of the whole. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

Reserved amount = $\frac{5}{9} \times 720 = \text{GBP } 400$. Remainder = GBP 320. One ratio part = $320 / (8) = \text{GBP } 40$. Shares are GBP 200 and GBP 120; the second is $\frac{1}{6}$ of the whole. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN11 - Fractions in ratio problems • Questions 3-4

Q03 | 4 MARKS

Reserved amount = $\frac{1}{5} \times 450 = \text{GBP } 90$. Remainder = GBP 360. One ratio part = $360 / (9) = \text{GBP } 40$. Shares are GBP 120 and GBP 240; the second is $\frac{8}{15}$ of the whole. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

Reserved amount = $\frac{1}{8} \times 720 = \text{GBP } 90$. Remainder = GBP 630. One ratio part = $630 / (9) = \text{GBP } 70$. Shares are GBP 420 and GBP 210; the second is $\frac{7}{24}$ of the whole. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN11 - Fractions in ratio problems • Questions 5-6

Q05 | 4 MARKS

Reserved amount= $\frac{1}{11} \times 1100 = \text{GBP } 100$. Remainder= $\text{GBP } 1000$. One ratio part= $1000/(10) = \text{GBP } 100$. Shares are GBP 400 and GBP 600; the second is $\frac{6}{11}$ of the whole. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

Reserved amount= $\frac{1}{7} \times 350 = \text{GBP } 50$. Remainder= $\text{GBP } 300$. One ratio part= $300/(5) = \text{GBP } 60$. Shares are GBP 120 and GBP 180; the second is $\frac{18}{35}$ of the whole. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN11 - Fractions in ratio problems • Questions 7-8

Q07 | 4 MARKS

Reserved amount= $\frac{2}{10} \times 1100 = \text{GBP } 220$. Remainder= $\text{GBP } 880$. One ratio part= $\frac{880}{(11)} = \text{GBP } 80$. Shares are $\text{GBP } 400$ and $\text{GBP } 480$; the second is $\frac{24}{55}$ of the whole. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

Reserved amount= $\frac{1}{6} \times 360 = \text{GBP } 60$. Remainder= $\text{GBP } 300$. One ratio part= $\frac{300}{(6)} = \text{GBP } 50$. Shares are $\text{GBP } 150$ and $\text{GBP } 150$; the second is $\frac{5}{12}$ of the whole. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN11 - Fractions in ratio problems • Questions 9-10

Q09 | 5 MARKS

Reserved amount = $\frac{5}{9} \times 1080 = \text{GBP } 600$. Remainder = GBP 480. One ratio part = $480 / (12) = \text{GBP } 40$. Shares are GBP 240 and GBP 240; the second is $\frac{2}{9}$ of the whole. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Q10 | 5 MARKS

Reserved amount = $\frac{1}{5} \times 350 = \text{GBP } 70$. Remainder = GBP 280. One ratio part = $280 / (7) = \text{GBP } 40$. Shares are GBP 160 and GBP 120; the second is $\frac{12}{35}$ of the whole. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN11 - Fractions in ratio problems • Questions 11-12

Q11 | 5 MARKS

Reserved amount = $\frac{4}{6} \times 540 = \text{GBP } 360$. Remainder = GBP 180. One ratio part = $180 / (9) = \text{GBP } 20$. Shares are GBP 100 and GBP 80; the second is $\frac{4}{27}$ of the whole. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 5 MARKS

Reserved amount = $\frac{5}{7} \times 770 = \text{GBP } 550$. Remainder = GBP 220. One ratio part = $220 / (11) = \text{GBP } 20$. Shares are GBP 120 and GBP 100; the second is $\frac{10}{77}$ of the whole. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN11 - Fractions in ratio problems

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 1 • CHAPTER 12****HN12 - Fractions and percentages as operators****Chapter purpose**

Model percentage change, reverse percentage and repeated multipliers.

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

HN12 - Fractions and percentages as operators

Specification focus

Model percentage change, reverse percentage and repeated multipliers.

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

HN12 - Fractions and percentages as operators • Questions 1-2

Q01 | 4 MARKS

Find 40% of GBP 540. Increase GBP 540 by 40%, then reverse your increase to recover the original amount. Explain why subtracting 40% of the new amount would not reverse it exactly. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Find 15% of GBP 600. Increase GBP 600 by 15%, then reverse your increase to recover the original amount. Explain why subtracting 15% of the new amount would not reverse it exactly. Your solution must justify the main method or assumption and include a final check.

Chapter 12 • Practice

HN12 - Fractions and percentages as operators • Questions 3-4

Q03 | 4 MARKS

Find 30% of GBP 660. Increase GBP 660 by 30%, then reverse your increase to recover the original amount. Explain why subtracting 30% of the new amount would not reverse it exactly. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Find 5% of GBP 720. Increase GBP 720 by 5%, then reverse your increase to recover the original amount. Explain why subtracting 5% of the new amount would not reverse it exactly. Your solution must justify the main method or assumption and include a final check.

Chapter 12 • Practice

HN12 - Fractions and percentages as operators • Questions 5-6

Q05 | 4 MARKS

Find 20% of GBP 780. Increase GBP 780 by 20%, then reverse your increase to recover the original amount. Explain why subtracting 20% of the new amount would not reverse it exactly. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Find 35% of GBP 840. Increase GBP 840 by 35%, then reverse your increase to recover the original amount. Explain why subtracting 35% of the new amount would not reverse it exactly. Your solution must justify the main method or assumption and include a final check.

Chapter 12 • Practice

HN12 - Fractions and percentages as operators • Questions 7-8

Q07 | 4 MARKS

Find 10% of GBP 900. Increase GBP 900 by 10%, then reverse your increase to recover the original amount. Explain why subtracting 10% of the new amount would not reverse it exactly. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Find 25% of GBP 960. Increase GBP 960 by 25%, then reverse your increase to recover the original amount. Explain why subtracting 25% of the new amount would not reverse it exactly. Your solution must justify the main method or assumption and include a final check.

Chapter 12 • Practice

HN12 - Fractions and percentages as operators • Questions 9-10

Q09 | 5 MARKS

You must show your working. Find 40% of GBP 1020. Increase GBP 1020 by 40%, then reverse your increase to recover the original amount. Explain why subtracting 40% of the new amount would not reverse it exactly. Your solution must justify the main method or assumption and include a final check.

Q10 | 5 MARKS

You must show your working. Find 15% of GBP 1080. Increase GBP 1080 by 15%, then reverse your increase to recover the original amount. Explain why subtracting 15% of the new amount would not reverse it exactly. Your solution must justify the main method or assumption and include a final check.

Chapter 12 • Practice

HN12 - Fractions and percentages as operators • Questions 11-12

Q11 | 5 MARKS

You must show your working. Find 20% of GBP 1100. Increase GBP 1100 by 20%, then reverse your increase to recover the original amount. Explain why subtracting 20% of the new amount would not reverse it exactly. Your solution must justify the main method or assumption and include a final check.

Q12 | 5 MARKS

You must show your working. Find 25% of GBP 1120. Increase GBP 1120 by 25%, then reverse your increase to recover the original amount. Explain why subtracting 25% of the new amount would not reverse it exactly. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 12

HN12 - Fractions and percentages as operators • Questions 1-2

Q01 | 4 MARKS

40% of GBP 540=GBP 216.00. Increased amount=GBP 756.00. Reverse by dividing by multiplier 1.40: GBP 756.00/1.40=GBP 540.00. The decrease would use a different base amount. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

15% of GBP 600=GBP 90.00. Increased amount=GBP 690.00. Reverse by dividing by multiplier 1.15: GBP 690.00/1.15=GBP 600.00. The decrease would use a different base amount. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN12 - Fractions and percentages as operators • Questions 3-4

Q03 | 4 MARKS

30% of GBP 660=GBP 198.00. Increased amount=GBP 858.00. Reverse by dividing by multiplier 1.30: GBP 858.00/1.30=GBP 660.00. The decrease would use a different base amount. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

5% of GBP 720=GBP 36.00. Increased amount=GBP 756.00. Reverse by dividing by multiplier 1.05: GBP 756.00/1.05=GBP 720.00. The decrease would use a different base amount. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN12 - Fractions and percentages as operators • Questions 5-6

Q05 | 4 MARKS

20% of GBP 780=GBP 156.00. Increased amount=GBP 936.00. Reverse by dividing by multiplier 1.20: GBP 936.00/1.20=GBP 780.00. The decrease would use a different base amount. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

35% of GBP 840=GBP 294.00. Increased amount=GBP 1134.00. Reverse by dividing by multiplier 1.35: GBP 1134.00/1.35=GBP 840.00. The decrease would use a different base amount. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN12 - Fractions and percentages as operators • Questions 7-8

Q07 | 4 MARKS

10% of GBP 900=GBP 90.00. Increased amount=GBP 990.00. Reverse by dividing by multiplier 1.10: GBP 990.00/1.10=GBP 900.00. The decrease would use a different base amount. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

25% of GBP 960=GBP 240.00. Increased amount=GBP 1200.00. Reverse by dividing by multiplier 1.25: GBP 1200.00/1.25=GBP 960.00. The decrease would use a different base amount. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN12 - Fractions and percentages as operators • Questions 9-10

Q09 | 5 MARKS

40% of GBP 1020=GBP 408.00. Increased amount=GBP 1428.00. Reverse by dividing by multiplier 1.40: GBP 1428.00/1.40=GBP 1020.00. The decrease would use a different base amount. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Q10 | 5 MARKS

15% of GBP 1080=GBP 162.00. Increased amount=GBP 1242.00. Reverse by dividing by multiplier 1.15: GBP 1242.00/1.15=GBP 1080.00. The decrease would use a different base amount. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN12 - Fractions and percentages as operators • Questions 11-12

Q11 | 5 MARKS

20% of GBP 1100=GBP 220.00. Increased amount=GBP 1320.00. Reverse by dividing by multiplier 1.20: GBP 1320.00/1.20=GBP 1100.00. The decrease would use a different base amount. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 5 MARKS

25% of GBP 1120=GBP 280.00. Increased amount=GBP 1400.00. Reverse by dividing by multiplier 1.25: GBP 1400.00/1.25=GBP 1120.00. The decrease would use a different base amount. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN12 - Fractions and percentages as operators

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 1 • CHAPTER 13****HN13 - Measures and compound measures****Chapter purpose**

Use standard units and compound measures accurately in multi-stage contexts.

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

HN13 - Measures and compound measures

Specification focus

Use standard units and compound measures accurately in multi-stage contexts.

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

HN13 - Measures and compound measures • Questions 1-2

Q01 | 4 MARKS

A component has mass 2700 g and volume 75 cm^3 . Find its density. A force of 600 N acts over 40 cm^2 ; convert the area to m^2 and find the pressure in Pa. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

A component has mass 3000 g and volume 50 cm^3 . Find its density. A force of 660 N acts over 25 cm^2 ; convert the area to m^2 and find the pressure in Pa. Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HN13 - Measures and compound measures • Questions 3-4

Q03 | 4 MARKS

A component has mass 3300 g and volume 65 cm^3 . Find its density. A force of 720 N acts over 40 cm^2 ; convert the area to m^2 and find the pressure in Pa. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

A component has mass 3600 g and volume 40 cm^3 . Find its density. A force of 780 N acts over 25 cm^2 ; convert the area to m^2 and find the pressure in Pa. Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HN13 - Measures and compound measures • Questions 5-6

Q05 | 4 MARKS

A component has mass 3900 g and volume 55 cm^3 . Find its density. A force of 840 N acts over 40 cm^2 ; convert the area to m^2 and find the pressure in Pa. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

A component has mass 4200 g and volume 70 cm^3 . Find its density. A force of 900 N acts over 25 cm^2 ; convert the area to m^2 and find the pressure in Pa. Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HN13 - Measures and compound measures • Questions 7-8

Q07 | 4 MARKS

A component has mass 4500 g and volume 45 cm^3 . Find its density. A force of 960 N acts over 40 cm^2 ; convert the area to m^2 and find the pressure in Pa. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

A component has mass 4800 g and volume 60 cm^3 . Find its density. A force of 1020 N acts over 25 cm^2 ; convert the area to m^2 and find the pressure in Pa. Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HN13 - Measures and compound measures • Questions 9-10

Q09 | 5 MARKS

You must show your working. A component has mass 5100 g and volume 75 cm^3 . Find its density. A force of 1080 N acts over 40 cm^2 ; convert the area to m^2 and find the pressure in Pa. Your solution must justify the main method or assumption and include a final check.

Q10 | 5 MARKS

You must show your working. A component has mass 5400 g and volume 50 cm^3 . Find its density. A force of 1140 N acts over 25 cm^2 ; convert the area to m^2 and find the pressure in Pa. Your solution must justify the main method or assumption and include a final check.

Chapter 13 • Practice

HN13 - Measures and compound measures • Questions 11-12

Q11 | 5 MARKS

You must show your working. A component has mass 5500 g and volume 55 cm³. Find its density. A force of 1160 N acts over 30 cm²; convert the area to m² and find the pressure in Pa. Your solution must justify the main method or assumption and include a final check.

Q12 | 5 MARKS

You must show your working. A component has mass 5600 g and volume 60 cm³. Find its density. A force of 1180 N acts over 35 cm²; convert the area to m² and find the pressure in Pa. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 13

HN13 - Measures and compound measures • Questions 1-2

Q01 | 4 MARKS

Density= $2700/75=36 \text{ g/cm}^3$. Area= $40/10000=0.004 \text{ m}^2$. Pressure= $600/0.004=150000 \text{ Pa}$. Compound units require each base-unit conversion before division. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

Density= $3000/50=60 \text{ g/cm}^3$. Area= $25/10000=0.0025 \text{ m}^2$. Pressure= $660/0.0025=264000 \text{ Pa}$. Compound units require each base-unit conversion before division. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN13 - Measures and compound measures • Questions 3-4

Q03 | 4 MARKS

Density = $3300/65 = 660/13 \text{ g/cm}^3$. Area = $40/10000 = 0.004 \text{ m}^2$. Pressure = $720/0.004 = 180000 \text{ Pa}$. Compound units require each base-unit conversion before division. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

Density = $3600/40 = 90 \text{ g/cm}^3$. Area = $25/10000 = 0.0025 \text{ m}^2$. Pressure = $780/0.0025 = 312000 \text{ Pa}$. Compound units require each base-unit conversion before division. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN13 - Measures and compound measures • Questions 5-6

Q05 | 4 MARKS

Density= $3900/55=780/11$ g/cm³. Area= $40/10000=0.004$ m². Pressure= $840/0.004=210000$ Pa. Compound units require each base-unit conversion before division. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

Density= $4200/70=60$ g/cm³. Area= $25/10000=0.0025$ m². Pressure= $900/0.0025=360000$ Pa. Compound units require each base-unit conversion before division. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN13 - Measures and compound measures • Questions 7–8

Q07 | 4 MARKS

Density= $4500/45=100 \text{ g/cm}^3$. Area= $40/10000=0.004 \text{ m}^2$. Pressure= $960/0.004=240000 \text{ Pa}$. Compound units require each base-unit conversion before division. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

Density= $4800/60=80 \text{ g/cm}^3$. Area= $25/10000=0.0025 \text{ m}^2$. Pressure= $1020/0.0025=408000 \text{ Pa}$. Compound units require each base-unit conversion before division. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN13 - Measures and compound measures • Questions 9-10

Q09 | 5 MARKS

Density= $5100/75=68 \text{ g/cm}^3$. Area= $40/10000=0.004 \text{ m}^2$. Pressure= $1080/0.004=270000 \text{ Pa}$. Compound units require each base-unit conversion before division. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Q10 | 5 MARKS

Density= $5400/50=108 \text{ g/cm}^3$. Area= $25/10000=0.0025 \text{ m}^2$. Pressure= $1140/0.0025=456000 \text{ Pa}$. Compound units require each base-unit conversion before division. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN13 - Measures and compound measures • Questions 11-12

Q11 | 5 MARKS

Density= $5500/55=100 \text{ g/cm}^3$. Area= $30/10000=0.003 \text{ m}^2$. Pressure= $1160/0.003=386667 \text{ Pa}$. Compound units require each base-unit conversion before division. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 5 MARKS

Density= $5600/60=280/3 \text{ g/cm}^3$. Area= $35/10000=0.0035 \text{ m}^2$. Pressure= $1180/0.0035=337143 \text{ Pa}$. Compound units require each base-unit conversion before division. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN13 - Measures and compound measures

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 1 • CHAPTER 14****HN14 - Estimation and checking****Chapter purpose**

Choose approximations, estimate answers and judge whether calculator results are reasonable.

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

HN14 - Estimation and checking

Specification focus

Choose approximations, estimate answers and judge whether calculator results are reasonable.

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

HN14 - Estimation and checking • Questions 1-2

Q01 | 4 MARKS

Round 233.106 to 1 decimal place(s) and 3 significant figures. Estimate $(233.1 \times 20)/4$ using one significant figure values. Write the error interval for your decimal-place rounded value. Before calculating exactly, produce a one-significant-figure estimate and use it to assess whether your final answer is reasonable. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Round 255.036 to 1 decimal place(s) and 2 significant figures. Estimate $(255.0 \times 23)/7$ using one significant figure values. Write the error interval for your decimal-place rounded value. Before calculating exactly, produce a one-significant-figure estimate and use it to assess whether your final answer is reasonable. Your solution must justify the main method or assumption and include a final check.

Chapter 14 • Practice

HN14 - Estimation and checking • Questions 3-4

Q03 | 4 MARKS

Round 276.966 to 1 decimal place(s) and 3 significant figures. Estimate $(277.0 \times 19)/5$ using one significant figure values. Write the error interval for your decimal-place rounded value. Before calculating exactly, produce a one-significant-figure estimate and use it to assess whether your final answer is reasonable. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Round 298.896 to 1 decimal place(s) and 2 significant figures. Estimate $(298.9 \times 22)/8$ using one significant figure values. Write the error interval for your decimal-place rounded value. Before calculating exactly, produce a one-significant-figure estimate and use it to assess whether your final answer is reasonable. Your solution must justify the main method or assumption and include a final check.

Chapter 14 • Practice

HN14 - Estimation and checking • Questions 5-6

Q05 | 4 MARKS

Round 320.826 to 1 decimal place(s) and 3 significant figures. Estimate $(320.8 \times 25)/6$ using one significant figure values. Write the error interval for your decimal-place rounded value. Before calculating exactly, produce a one-significant-figure estimate and use it to assess whether your final answer is reasonable. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Round 342.756 to 1 decimal place(s) and 2 significant figures. Estimate $(342.8 \times 21)/4$ using one significant figure values. Write the error interval for your decimal-place rounded value. Before calculating exactly, produce a one-significant-figure estimate and use it to assess whether your final answer is reasonable. Your solution must justify the main method or assumption and include a final check.

Chapter 14 • Practice

HN14 - Estimation and checking • Questions 7-8

Q07 | 4 MARKS

Round 364.686 to 1 decimal place(s) and 3 significant figures. Estimate $(364.7 \times 24)/7$ using one significant figure values. Write the error interval for your decimal-place rounded value. Before calculating exactly, produce a one-significant-figure estimate and use it to assess whether your final answer is reasonable. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Round 386.616 to 1 decimal place(s) and 2 significant figures. Estimate $(386.6 \times 20)/5$ using one significant figure values. Write the error interval for your decimal-place rounded value. Before calculating exactly, produce a one-significant-figure estimate and use it to assess whether your final answer is reasonable. Your solution must justify the main method or assumption and include a final check.

Chapter 14 • Practice

HN14 - Estimation and checking • Questions 9-10

Q09 | 5 MARKS

You must show your working. Round 408.546 to 1 decimal place(s) and 3 significant figures. Estimate $(408.5 \times 23)/8$ using one significant figure values. Write the error interval for your decimal-place rounded value. Before calculating exactly, produce a one-significant-figure estimate and use it to assess whether your final answer is reasonable. Your solution must justify the main method or assumption and include a final check.

Q10 | 5 MARKS

You must show your working. Round 430.476 to 1 decimal place(s) and 2 significant figures. Estimate $(430.5 \times 19)/6$ using one significant figure values. Write the error interval for your decimal-place rounded value. Before calculating exactly, produce a one-significant-figure estimate and use it to assess whether your final answer is reasonable. Your solution must justify the main method or assumption and include a final check.

Chapter 14 • Practice

HN14 - Estimation and checking • Questions 11-12

Q11 | 5 MARKS

You must show your working. Round 437.786 to 2 decimal place(s) and 3 significant figures. Estimate $(437.8 \times 20)/7$ using one significant figure values. Write the error interval for your decimal-place rounded value. Before calculating exactly, produce a one-significant-figure estimate and use it to assess whether your final answer is reasonable. Your solution must justify the main method or assumption and include a final check.

Q12 | 5 MARKS

You must show your working. Round 445.096 to 3 decimal place(s) and 2 significant figures. Estimate $(445.1 \times 21)/8$ using one significant figure values. Write the error interval for your decimal-place rounded value. Before calculating exactly, produce a one-significant-figure estimate and use it to assess whether your final answer is reasonable. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 14

HN14 - Estimation and checking • Questions 1-2

Q01 | 4 MARKS

To 1 d.p.: 233.1. To 3 s.f.: 233. A one-significant-figure estimate is approximately 1000. Error interval: $233.05 \leq x < 233.15$; the upper bound is excluded. Award the checking credit only when a stated estimate is compared explicitly with the final value. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

To 1 d.p.: 255.0. To 2 s.f.: 260. A one-significant-figure estimate is approximately 857.143. Error interval: $254.95 \leq x < 255.05$; the upper bound is excluded. Award the checking credit only when a stated estimate is compared explicitly with the final value. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN14 - Estimation and checking • Questions 3-4

Q03 | 4 MARKS

To 1 d.p.: 277.0. To 3 s.f.: 277. A one-significant-figure estimate is approximately 1200. Error interval: $276.95 \leq x < 277.05$; the upper bound is excluded. Award the checking credit only when a stated estimate is compared explicitly with the final value. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

To 1 d.p.: 298.9. To 2 s.f.: 300. A one-significant-figure estimate is approximately 750. Error interval: $298.85 \leq x < 298.95$; the upper bound is excluded. Award the checking credit only when a stated estimate is compared explicitly with the final value. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN14 - Estimation and checking • Questions 5-6

Q05 | 4 MARKS

To 1 d.p.: 320.8. To 3 s.f.: 321. A one-significant-figure estimate is approximately 1000. Error interval: $320.75 \leq x < 320.85$; the upper bound is excluded. Award the checking credit only when a stated estimate is compared explicitly with the final value. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

To 1 d.p.: 342.8. To 2 s.f.: 340. A one-significant-figure estimate is approximately 1500. Error interval: $342.75 \leq x < 342.85$; the upper bound is excluded. Award the checking credit only when a stated estimate is compared explicitly with the final value. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN14 - Estimation and checking • Questions 7-8

Q07 | 4 MARKS

To 1 d.p.: 364.7. To 3 s.f.: 365. A one-significant-figure estimate is approximately 1142.86. Error interval: $364.65 \leq x < 364.75$; the upper bound is excluded. Award the checking credit only when a stated estimate is compared explicitly with the final value. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

To 1 d.p.: 386.6. To 2 s.f.: 390. A one-significant-figure estimate is approximately 1600. Error interval: $386.55 \leq x < 386.65$; the upper bound is excluded. Award the checking credit only when a stated estimate is compared explicitly with the final value. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN14 - Estimation and checking • Questions 9-10

Q09 | 5 MARKS

To 1 d.p.: 408.5. To 3 s.f.: 409. A one-significant-figure estimate is approximately 1000. Error interval: $408.45 \leq x < 408.55$; the upper bound is excluded. Award the checking credit only when a stated estimate is compared explicitly with the final value. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Q10 | 5 MARKS

To 1 d.p.: 430.5. To 2 s.f.: 430. A one-significant-figure estimate is approximately 1333.33. Error interval: $430.45 \leq x < 430.55$; the upper bound is excluded. Award the checking credit only when a stated estimate is compared explicitly with the final value. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN14 - Estimation and checking • Questions 11-12

Q11 | 5 MARKS

To 2 d.p.: 437.79. To 3 s.f.: 438. A one-significant-figure estimate is approximately 1142.86. Error interval: $437.785 \leq x < 437.795$; the upper bound is excluded. Award the checking credit only when a stated estimate is compared explicitly with the final value. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 5 MARKS

To 3 d.p.: 445.096. To 2 s.f.: 450. A one-significant-figure estimate is approximately 1000. Error interval: $445.0955 \leq x < 445.0965$; the upper bound is excluded. Award the checking credit only when a stated estimate is compared explicitly with the final value. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN14 - Estimation and checking

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 1 • CHAPTER 15****HN15 - Rounding and error intervals****Chapter purpose**

Round appropriately and express intervals created by rounding or truncation.

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

HN15 - Rounding and error intervals

Specification focus

Round appropriately and express intervals created by rounding or truncation.

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

HN15 - Rounding and error intervals • Questions 1-2

Q01 | 4 MARKS

Round 328.136 to 2 decimal place(s) and 2 significant figures. Estimate $(328.1 \times 19)/7$ using one significant figure values. Write the error interval for your decimal-place rounded value. State the relevant rounding or truncation interval using inequalities before completing the task. Your solution must justify the main method or assumption and include a final check.

Q02 | 4 MARKS

Round 350.066 to 2 decimal place(s) and 3 significant figures. Estimate $(350.1 \times 22)/5$ using one significant figure values. Write the error interval for your decimal-place rounded value. State the relevant rounding or truncation interval using inequalities before completing the task. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HN15 - Rounding and error intervals • Questions 3-4

Q03 | 4 MARKS

Round 371.996 to 2 decimal place(s) and 2 significant figures. Estimate $(372.0 \times 25)/8$ using one significant figure values. Write the error interval for your decimal-place rounded value. State the relevant rounding or truncation interval using inequalities before completing the task. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Round 393.926 to 2 decimal place(s) and 3 significant figures. Estimate $(393.9 \times 21)/6$ using one significant figure values. Write the error interval for your decimal-place rounded value. State the relevant rounding or truncation interval using inequalities before completing the task. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HN15 - Rounding and error intervals • Questions 5-6

Q05 | 5 MARKS

You must show your working. Round 415.856 to 2 decimal place(s) and 2 significant figures. Estimate $(415.9 \times 24) / 4$ using one significant figure values. Write the error interval for your decimal-place rounded value. State the relevant rounding or truncation interval using inequalities before completing the task. Your solution must justify the main method or assumption and include a final check.

Q06 | 5 MARKS

You must show your working. Round 437.786 to 2 decimal place(s) and 3 significant figures. Estimate $(437.8 \times 20) / 7$ using one significant figure values. Write the error interval for your decimal-place rounded value. State the relevant rounding or truncation interval using inequalities before completing the task. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HN15 - Rounding and error intervals • Questions 7-8

Q07 | 4 MARKS

Round 125.5 to the nearest whole number. State the relevant rounding or truncation interval using inequalities before completing the task. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Round 131.8 to the nearest whole number. State the relevant rounding or truncation interval using inequalities before completing the task. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HN15 - Rounding and error intervals • Questions 9-10

Q09 | 4 MARKS

Round 138.1 to 1 significant figure and 1 decimal place. State the relevant rounding or truncation interval using inequalities before completing the task. Your solution must justify the main method or assumption and include a final check.

Q10 | 4 MARKS

Round 144.4 to 1 significant figure and 1 decimal place. State the relevant rounding or truncation interval using inequalities before completing the task. Your solution must justify the main method or assumption and include a final check.

Chapter 15 • Practice

HN15 - Rounding and error intervals • Questions 11-12

Q11 | 4 MARKS

Round 146.5 to 1 significant figure and 1 decimal place. State the relevant rounding or truncation interval using inequalities before completing the task. Your solution must justify the main method or assumption and include a final check.

Q12 | 4 MARKS

Round 148.6 to 1 significant figure and 1 decimal place. State the relevant rounding or truncation interval using inequalities before completing the task. Your solution must justify the main method or assumption and include a final check.

Worked solutions • Chapter 15

HN15 - Rounding and error intervals • Questions 1-2

Q01 | 4 MARKS

To 2 d.p.: 328.14. To 2 s.f.: 330. A one-significant-figure estimate is approximately 857.143. Error interval: $328.135 \leq x < 328.145$; the upper bound is excluded. The interval must include the correct inclusive lower endpoint and exclusive upper endpoint. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

To 2 d.p.: 350.07. To 3 s.f.: 350. A one-significant-figure estimate is approximately 1600. Error interval: $350.065 \leq x < 350.075$; the upper bound is excluded. The interval must include the correct inclusive lower endpoint and exclusive upper endpoint. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN15 - Rounding and error intervals • Questions 3-4

Q03 | 4 MARKS

To 2 d.p.: 372.0. To 2 s.f.: 370. A one-significant-figure estimate is approximately 1000. Error interval: $371.995 \leq x < 372.005$; the upper bound is excluded. The interval must include the correct inclusive lower endpoint and exclusive upper endpoint. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

To 2 d.p.: 393.93. To 3 s.f.: 394. A one-significant-figure estimate is approximately 1333.33. Error interval: $393.925 \leq x < 393.935$; the upper bound is excluded. The interval must include the correct inclusive lower endpoint and exclusive upper endpoint. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN15 - Rounding and error intervals • Questions 5-6

Q05 | 5 MARKS

To 2 d.p.: 415.86. To 2 s.f.: 420. A one-significant-figure estimate is approximately 2000. Error interval: $415.855 \leq x < 415.865$; the upper bound is excluded. The interval must include the correct inclusive lower endpoint and exclusive upper endpoint. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific marking check

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

Q06 | 5 MARKS

To 2 d.p.: 437.79. To 3 s.f.: 438. A one-significant-figure estimate is approximately 1142.86. Error interval: $437.785 \leq x < 437.795$; the upper bound is excluded. The interval must include the correct inclusive lower endpoint and exclusive upper endpoint. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN15 - Rounding and error intervals • Questions 7-8

Q07 | 4 MARKS

126. The interval must include the correct inclusive lower endpoint and exclusive upper endpoint. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

132. The interval must include the correct inclusive lower endpoint and exclusive upper endpoint. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN15 - Rounding and error intervals • Questions 9-10

Q09 | 4 MARKS

100 and 138.1. The interval must include the correct inclusive lower endpoint and exclusive upper endpoint. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

100 and 144.4. The interval must include the correct inclusive lower endpoint and exclusive upper endpoint. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN15 - Rounding and error intervals • Questions 11-12

Q11 | 4 MARKS

100 and 146.5. The interval must include the correct inclusive lower endpoint and exclusive upper endpoint. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 4 MARKS

100 and 148.6. The interval must include the correct inclusive lower endpoint and exclusive upper endpoint. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN15 - Rounding and error intervals

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 1 • CHAPTER 16****HN16 - Limits of accuracy and bounds****Chapter purpose**

Apply upper and lower bounds to multi-stage calculations and contextual conclusions.

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

HN16 - Limits of accuracy and bounds

Specification focus

Apply upper and lower bounds to multi-stage calculations and contextual conclusions.

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

HN16 - Limits of accuracy and bounds • Questions 1-2

Q01 | 5 MARKS

You must show your working. Round 423.166 to 3 decimal place(s) and 3 significant figures. Estimate $(423.2 \times 25)/5$ using one significant figure values. Write the error interval for your decimal-place rounded value. Use the appropriate extreme values to justify whether the required result is an upper bound or a lower bound.

Q02 | 5 MARKS

You must show your working. Round 445.096 to 3 decimal place(s) and 2 significant figures. Estimate $(445.1 \times 21)/8$ using one significant figure values. Write the error interval for your decimal-place rounded value. Use the appropriate extreme values to justify whether the required result is an upper bound or a lower bound.

Chapter 16 • Practice

HN16 - Limits of accuracy and bounds • Questions 3-4

Q03 | 4 MARKS

Round 127.6 to the nearest whole number. Use the appropriate extreme values to justify whether the required result is an upper bound or a lower bound. Your solution must justify the main method or assumption and include a final check.

Q04 | 4 MARKS

Round 133.9 to 1 significant figure and 1 decimal place. Use the appropriate extreme values to justify whether the required result is an upper bound or a lower bound. Your solution must justify the main method or assumption and include a final check.

Chapter 16 • Practice

HN16 - Limits of accuracy and bounds • Questions 5-6

Q05 | 4 MARKS

Round 140.2 to 1 significant figure and 1 decimal place. Use the appropriate extreme values to justify whether the required result is an upper bound or a lower bound. Your solution must justify the main method or assumption and include a final check.

Q06 | 4 MARKS

Round 146.5 to 1 significant figure and 1 decimal place. Use the appropriate extreme values to justify whether the required result is an upper bound or a lower bound. Your solution must justify the main method or assumption and include a final check.

Chapter 16 • Practice

HN16 - Limits of accuracy and bounds • Questions 7-8

Q07 | 4 MARKS

Round 152.8 to 1 significant figure and 1 decimal place. Use the appropriate extreme values to justify whether the required result is an upper bound or a lower bound. Your solution must justify the main method or assumption and include a final check.

Q08 | 4 MARKS

Round 247.726 to 3 decimal place(s) and 3 significant figures. Estimate $(247.7 \times 22)/6$ using one significant figure values. Write the error interval for your decimal-place rounded value. Use the appropriate extreme values to justify whether the required result is an upper bound or a lower bound.

Chapter 16 • Practice

HN16 - Limits of accuracy and bounds • Questions 9-10

Q09 | 4 MARKS

Round 269.656 to 3 decimal place(s) and 2 significant figures. Estimate $(269.7 \times 25)/4$ using one significant figure values. Write the error interval for your decimal-place rounded value. Use the appropriate extreme values to justify whether the required result is an upper bound or a lower bound.

Q10 | 4 MARKS

Round 291.586 to 3 decimal place(s) and 3 significant figures. Estimate $(291.6 \times 21)/7$ using one significant figure values. Write the error interval for your decimal-place rounded value. Use the appropriate extreme values to justify whether the required result is an upper bound or a lower bound.

Chapter 16 • Practice

HN16 - Limits of accuracy and bounds • Questions 11-12

Q11 | 4 MARKS

Round 298.896 to 1 decimal place(s) and 2 significant figures. Estimate $(298.9 \times 22)/8$ using one significant figure values. Write the error interval for your decimal-place rounded value. Use the appropriate extreme values to justify whether the required result is an upper bound or a lower bound.

Q12 | 4 MARKS

Round 306.206 to 2 decimal place(s) and 3 significant figures. Estimate $(306.2 \times 23)/4$ using one significant figure values. Write the error interval for your decimal-place rounded value. Use the appropriate extreme values to justify whether the required result is an upper bound or a lower bound.

Worked solutions • Chapter 16

HN16 - Limits of accuracy and bounds • Questions 1-2

Q01 | 5 MARKS

To 3 d.p.: 423.166. To 3 s.f.: 423. A one-significant-figure estimate is approximately 1600. Error interval: $423.1655 \leq x < 423.1665$; the upper bound is excluded. The justification must explain the choice of every extreme value used. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 5 MARKS

To 3 d.p.: 445.096. To 2 s.f.: 450. A one-significant-figure estimate is approximately 1000. Error interval: $445.0955 \leq x < 445.0965$; the upper bound is excluded. The justification must explain the choice of every extreme value used. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN16 - Limits of accuracy and bounds • Questions 3-4

Q03 | 4 MARKS

128. The justification must explain the choice of every extreme value used. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

100 and 133.9. The justification must explain the choice of every extreme value used. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN16 - Limits of accuracy and bounds • Questions 5-6

Q05 | 4 MARKS

100 and 140.2. The justification must explain the choice of every extreme value used. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

100 and 146.5. The justification must explain the choice of every extreme value used. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN16 - Limits of accuracy and bounds • Questions 7-8

Q07 | 4 MARKS

200 and 152.8. The justification must explain the choice of every extreme value used. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

To 3 d.p.: 247.726. To 3 s.f.: 248. A one-significant-figure estimate is approximately 666.667. Error interval: $247.7255 \leq x < 247.7265$; the upper bound is excluded. The justification must explain the choice of every extreme value used. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN16 - Limits of accuracy and bounds • Questions 9-10

Q09 | 4 MARKS

To 3 d.p.: 269.656. To 2 s.f.: 270. A one-significant-figure estimate is approximately 1500. Error interval: $269.6555 \leq x < 269.6565$; the upper bound is excluded. The justification must explain the choice of every extreme value used. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

To 3 d.p.: 291.586. To 3 s.f.: 292. A one-significant-figure estimate is approximately 857.143. Error interval: $291.586 \leq x < 291.587$; the upper bound is excluded. The justification must explain the choice of every extreme value used. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN16 - Limits of accuracy and bounds • Questions 11-12

Q11 | 4 MARKS

To 1 d.p.: 298.9. To 2 s.f.: 300. A one-significant-figure estimate is approximately 750. Error interval: $298.85 \leq x < 298.95$; the upper bound is excluded. The justification must explain the choice of every extreme value used. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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 | 4 MARKS

To 2 d.p.: 306.21. To 3 s.f.: 306. A one-significant-figure estimate is approximately 1500. Error interval: $306.205 \leq x < 306.215$; the upper bound is excluded. The justification must explain the choice of every extreme value used. The written justification should identify the decisive method or assumption; the check should confirm the result independently or test it against the context.

Item-specific 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

HN16 - Limits of accuracy and bounds

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: _____