GCSE MATHEMATICS

FOUNDATION TIER

COMPREHENSIVE LESSON NOTEBOOK

UNIT 1 | NUMBER

TEACH-FROM-SCRATCH • FREE WEBSITE EDITION

13 detailed chapters • original diagrams • worked examples • guided practice • answers

Student: _____ Target grade: _____

START HERE

STUDY ROUTINE

How to learn from this notebook

Meaning first. Method second. Practice third.

THE FIVE-PASS ROUTINE

1 Read the key idea without a calculator. 2 Cover each solution and reproduce it. 3 Complete the practice independently. 4 Mark in a different colour and repair errors. 5 Retest after 2–7 days.

What a complete mathematics answer contains

- A clear model or calculation, not only a calculator display.
- Enough working for another person to follow the reasoning.
- Exact values until approximation is requested.
- Units and sensible rounding in context.
- A final sentence when the result must be interpreted.

Error log

REPAIR, DO NOT MERELY CORRECT

Label each error: concept, operation, arithmetic, calculator entry, accuracy, unit or interpretation. Write the corrected step and one sentence explaining the change.

Foundation does not mean superficial

Foundation Tier rewards secure fluency and connected reasoning. Grade 4–5 questions often combine several familiar skills, hide the required operation inside a context, or ask whether an answer is reasonable. The notebook therefore explains why methods work as well as how to use them.

SPECIFICATION MAP

PEARSON EDEXCEL 1MA1

Unit 1 coverage map

Number content organised into a teachable sequence.

CH 01	N1, N2	Place value, ordering, integers and directed numbers
CH 02	N2, N3	Four operations, inverses and BIDMAS
CH 03	N4	Factors, multiples, primes, HCF and LCM
CH 04	N6	Powers, roots and index laws used at Foundation
CH 05	N2, N9, N13	Fraction meaning and calculation
CH 06	N1, N2, N13	Decimals and conversion between forms
CH 07	N13	Percentages, multipliers and percentage change
CH 08	N7, N11	Standard form and calculator notation
CH 09	N14, N15	Rounding, estimation and accuracy
CH 10	N3, N5	Calculator strategy, listing and mixed problems

IMPORTANT TIER NOTE

This notebook follows the Foundation-assessable content identified in the Pearson Edexcel GCSE Mathematics (1MA1) specification. Higher-only material is excluded from the core lesson sequence unless it is clearly labelled as optional enrichment.

REFERENCE

NUMBER FACTS AND FORMULAS

Fast-reference method bank

Understand each formula before memorising it.

Percentage of amount	percentage ÷ 100 × amount
Percentage change	change ÷ original × 100%
New amount after change	original × complete multiplier
Fraction of amount	fraction × amount
Standard form	$A \times 10^n$ where $1 \leq A < 10$
Error interval	rounded value ± half the rounding unit
HCF	common prime factors with smallest powers
LCM	all required prime factors with greatest powers
Mean rate	total quantity ÷ total time or number of units
Simple interest	principal × decimal rate × time

CHAPTER 01 • N1-N2

N1, N2

Place value, ordering and directed numbers

Read magnitude and position before calculating.

SPECIFICATION FOCUS

Pearson Edexcel content references N1, N2. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

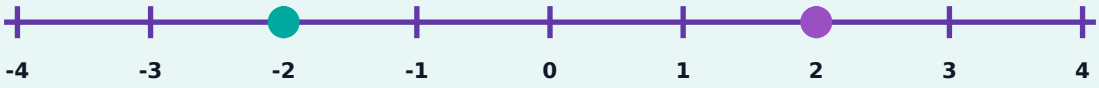
Understand the idea

Our base-ten system gives every digit a value determined by its position. Ordering is easiest when numbers are written in a comparable form and placed mentally on a number line. Negative numbers reverse a common intuition: -8 is less than -3 because -8 lies farther left.

KEY VOCABULARY

digit • place value • integer • ascending • descending • inequality • magnitude • directed number

Position shows order: farther right means greater



Why the method works

- A digit has both a face value and a place value: the 6 in 62,405 represents 60,000.
- For decimals, each move right divides the place value by 10. A zero can hold an essential position.
- To compare negative numbers, compare their positions: the number closer to zero is greater.
- Temperature, bank balances, lifts and altitude all use directed numbers.

CHECK BEFORE MOVING ON

Answer mentally: 1) Write 6,040,709 in words. 2) What is the value of 8 in 3.081? 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because …” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 01 • N1-N2 • METHODS

N1, N2

Place value, ordering and directed numbers — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Write numbers in aligned place-value columns.
- Convert fractions or percentages to decimals only when comparison requires it.
- Use < for “less than” and > for “greater than”; the open side faces the larger number.
- For a change, final − initial gives a signed result.

WORKED EXAMPLE 1

State the value of 7 in 4,072,615.

1. Locate the digit: it is in the ten-thousands column.
2. Multiply 7 by 10,000.

ANSWER: 70,000

WORKED EXAMPLE 2

Order −1.4, −3/2, 0.2 and −1.05.

1. Convert −3/2 to −1.5.
2. From left to right on a number line: −1.5, −1.4, −1.05, 0.2.

ANSWER: −3/2, −1.4, −1.05, 0.2

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes it easier to repair errors.

GUIDED TRY

Insert < or >: −7 ___ −2. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 01 • N1-N2 • APPLICATION

N1, N2

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

A freezer warms from −18°C to −5°C. The change is $-5-(-18)=+13$°C. The positive answer describes an increase even though both temperatures are below zero.

Common mistakes and how to repair them

MISTAKE 1

Thinking −8 is greater than −3 because 8 is greater than 3. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Removing placeholder zeros: 4.05 is not 4.5. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Confusing “difference” with “final value”. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Explain why $-0.8 < -0.35$. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 01 • N1-N2 • PRACTICE

N1, N2

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. **Write 6,040,709 in words.**

2. **What is the value of 8 in 3.081?**

3. **Insert < or >: −7 ___ −2.**

4. **Order 0.45, 43%, 1/2, 0.405.**

5. **Calculate the change from −6 to 11.**

6. **A lift travels from floor 4 to floor −3. How many floors?**

7. **Write the integer halfway between −9 and 5.**

8. **Explain why −0.8 < −0.35.**

REFLECTION

Circle one: secure / almost / reteach. Write the question number of your most useful error and the rule that repairs it.

CHAPTER 02 • N2-N3

N2, N3

Four operations, inverse operations and BIDMAS

Choose an operation from meaning, then calculate in a controlled order.

SPECIFICATION FOCUS

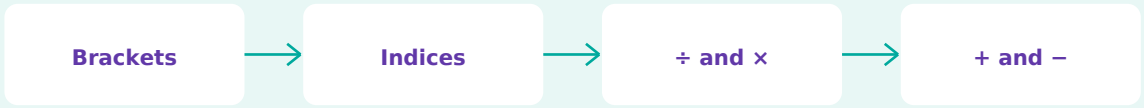
Pearson Edexcel content references N2, N3. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

Operations describe actions: addition combines or changes upward, subtraction finds a difference or removes, multiplication scales equal groups, and division shares or measures how many groups fit. BIDMAS removes ambiguity by fixing the order in which a mixed expression is interpreted.

KEY VOCABULARY

sum • difference • product • quotient • inverse • operation • expression • BIDMAS



Division/multiplication share a level; addition/subtraction share a level. Work left to right.

Why the method works

- Addition and subtraction are inverse operations; multiplication and division are inverse operations.
- Multiplication is not automatically done before division: they share a priority level and are processed left to right.
- Estimation exposes mistyped calculator entries and misplaced decimal points.
- A negative multiplied or divided by a negative gives a positive because reversing direction twice restores the original direction.

CHECK BEFORE MOVING ON

Answer mentally: 1) Calculate 7+4×6. 2) Calculate (18−5)×3. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because …” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 02 • N2-N3 • METHODS

N2, N3

Four operations, inverse operations and BIDMAS — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Work inside brackets first.
- Evaluate indices such as squares and cubes.
- Perform division and multiplication from left to right.
- Perform addition and subtraction from left to right.
- Check using the inverse operation or an estimate.

WORKED EXAMPLE 1

Calculate $18 - 3 \times (4 + 2)$.

1. Brackets: $4+2=6$.
2. Multiplication: $3\times6=18$.
3. Subtraction: $18-18=0$.

ANSWER: 0

WORKED EXAMPLE 2

A bill of £84 is shared equally among 6 people, then each adds a £2 tip.

1. Share first: $84\div6=14$.
2. Add the tip: $14+2=16$.

ANSWER: £16 each

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes it easier to repair errors.

GUIDED TRY

Calculate $48\div6\times2$. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 02 • N2-N3 • APPLICATION

N2, N3

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

A mobile plan starts at £12 and charges £0.08 for each of 135 extra minutes. Cost = 12 + 0.08×135 = £22.80. The multiplication is completed before the fixed charge is added.

Common mistakes and how to repair them

MISTAKE 1

Reading 30÷5×2 as 30÷10 instead of working left to right. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Treating subtraction of a negative as subtraction of its magnitude. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Using the calculator without recording the expression. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Use an inverse operation to check 672÷21=32. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 02 • N2-N3 • PRACTICE

N2, N3

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. **Calculate $7+4\times6$.**

2. **Calculate $(18-5)\times3$.**

3. **Calculate $48\div6\times2$.**

4. **Calculate $5^2-3\times4$.**

5. **Work out $-7+12-9$.**

6. **Work out $-6\times(-4)$.**

7. **A £240 phone is paid in 8 equal instalments plus a £5 fee each month. Find the monthly payment.**

8. **Use an inverse operation to check $672\div21=32$.**

REFLECTION

Circle one: secure / almost / reteach. Write the question number of your most useful error and the rule that repairs it.

CHAPTER 03 • N4

N4

Factors, multiples, primes, HCF and LCM

Use prime structure to solve grouping and repeating-event problems.

SPECIFICATION FOCUS

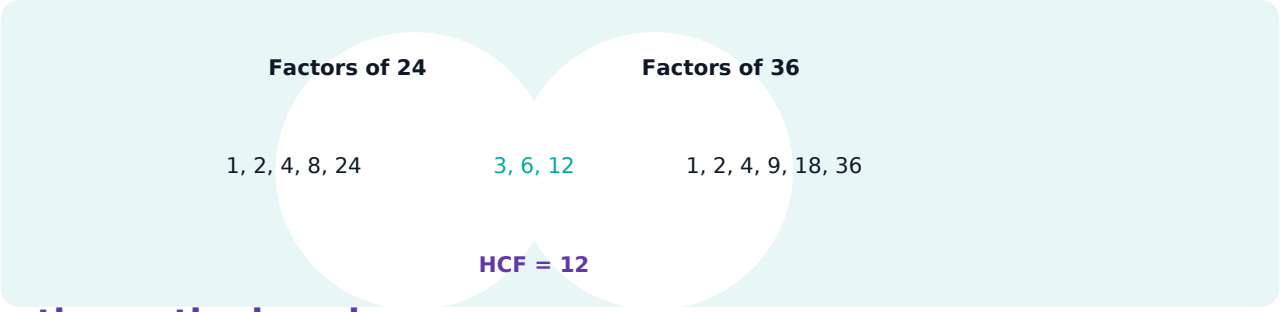
Pearson Edexcel content references N4. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

Factors divide exactly into a number; multiples are produced by multiplying it. Prime numbers have exactly two positive factors. Prime factorisation reveals the “building blocks” of an integer and provides a dependable route to highest common factors and lowest common multiples.

KEY VOCABULARY

factor • multiple • prime • composite • prime factorisation • HCF • LCM



Why the method works

- A factor pair multiplies to the target number. Search only up to the square root, then reverse the pairs.
- For HCF, take prime factors common to every number with the smallest power.
- For LCM, take every required prime factor with the greatest power.
- HCF solves largest equal grouping; LCM solves first shared repetition.

CHECK BEFORE MOVING ON

Answer mentally: 1) List all factors of 36. 2) Write the first five multiples of 14. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because …” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 03 • N4 • METHODS

N4

Factors, multiples, primes, HCF and LCM — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Divide by the smallest possible prime repeatedly.
- Write the factorisation with indices.
- For HCF, select the overlap.
- For LCM, combine enough factors to contain both numbers.

WORKED EXAMPLE 1

Write 360 as a product of prime factors.

1. $360=36\times10$.
2. $36=2^2\times3^2$ and $10=2\times5$.
3. Combine equal bases.

ANSWER: $2^3\times3^2\times5$

WORKED EXAMPLE 2

Find HCF and LCM of 72 and 120.

1. $72=2^3\times3^2$; $120=2^3\times3\times5$.
2. HCF uses $2^3\times3=24$.
3. LCM uses $2^3\times3^2\times5=360$.

ANSWER: HCF 24; LCM 360

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes it easier to repair errors.

GUIDED TRY

Is 91 prime? Explain. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 03 • N4 • APPLICATION

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

Two warning lights flash every 18 s and 24 s. Their next simultaneous flash occurs after LCM(18,24)=72 seconds. “At the same time again” signals an LCM problem.

Common mistakes and how to repair them

MISTAKE 1

Calling 1 a prime number. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Using a common multiple when the question requires the lowest. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Forgetting repeated prime factors in a factor tree. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Buses leave every 20 and 28 minutes. After how many minutes together again? Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 03 • N4 • PRACTICE

N4

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. **List all factors of 36.**

2. **Write the first five multiples of 14.**

3. **Is 91 prime? Explain.**

4. **Write 84 as a product of primes.**

5. **Find HCF(48,72).**

6. **Find LCM(15,24).**

7. **Ribbon lengths 84 cm and 126 cm are cut into the longest equal pieces. Find the piece length.**

8. **Buses leave every 20 and 28 minutes. After how many minutes together again?**

REFLECTION

Circle one: secure / almost / reteach. Write the question number of your most useful error and the rule that repairs it.

CHAPTER 04 • N6-N7

N6, N7

Powers, roots and Foundation index laws

See an index as repeated multiplication, not decoration.

SPECIFICATION FOCUS

Pearson Edexcel content references N6, N7. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

A power is a compact multiplication. The base is the repeated factor and the index counts how many copies appear. Square and cube roots reverse squaring and cubing. Index laws work because repeated factors can be counted, combined or cancelled. A negative integer index represents a reciprocal: $a^{-n}=1/a^n$ for non-zero a. This follows by continuing the division pattern through index zero.

KEY VOCABULARY

base • index • power • square • cube • square root • cube root • reciprocal

$$3^4 = 3 \times 3 \times 3 \times 3 = 81$$

base = repeated factor index = number of factors

Why the method works

- $a^m \times a^n$ contains m+n copies of a, so the indices add.
- $a^m \div a^n$ cancels n copies, leaving a^{m-n}.
- $(a^m)^n$ repeats a^m n times, giving a^{mn}.
- $a^{-n}=1/a^n$ because each one-step decrease in the index divides the value by a.

CHECK BEFORE MOVING ON

Answer mentally: 1) Evaluate 5^3. 2) Find $\sqrt{225}$. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because …” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 04 • N6-N7 • METHODS

N6, N7

Powers, roots and Foundation index laws — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Check that bases match before applying an index law.
- Evaluate roots by asking which positive number produces the given square or cube.
- Keep brackets around a negative base: $(-3)^2=9$ but $-3^2=-9$.
- Use prime factors to identify exact roots.

WORKED EXAMPLE 1

Simplify $2^5\times2^3\div2^4$.

1. Add indices for multiplication: 2^8.
2. Subtract the division index: 2^4.
3. Evaluate if requested.

ANSWER: $2^4=16$

WORKED EXAMPLE 2

Find $\sqrt{1764}$.

1. Recognise $1764=42\times42$, or use prime factors.
2. The principal square root is positive.

ANSWER: 42

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes it easier to repair errors.

GUIDED TRY

Find $\sqrt[3]{512}$. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 04 • N6-N7 • APPLICATION

N6, N7

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

A square patio has area 196 m². Its side length is √196=14 m. A cube-shaped tank of volume 729 m³ has edge length ∛729=9 m.

Common mistakes and how to repair them

MISTAKE 1

Multiplying indices when multiplying powers with the same base. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Assuming $(a+b)^2=a^2+b^2$. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Losing brackets around a negative base. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

A square has area 324 cm². Find its perimeter. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 04 • N6-N7 • PRACTICE

N6, N7

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. **Evaluate 5^3.**

2. **Find $\sqrt{225}$.**

3. **Find $\sqrt[3]{512}$.**

4. **Simplify $3^4 \times 3^2$.**

5. **Simplify $7^9 \div 7^5$.**

6. **Simplify $(2^3)^4$.**

7. **Evaluate 2^{-3}.**

8. **A square has area 324 cm^2. Find its perimeter.**

REFLECTION

Circle one: secure / almost / reteach. Write the question number of your most useful error and the rule that repairs it.

CHAPTER 05 • N2, N8, N10, N12

N2, N8, N10, N12

Fractions: meaning, equivalence and calculation

Treat a fraction as division, a proportion and a point on a number line.

SPECIFICATION FOCUS

Pearson Edexcel content references N2, N8, N10, N12. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

The denominator states how many equal parts make one whole; the numerator counts selected parts. Equivalent fractions name the same point. Addition and subtraction require equal-sized parts, so denominators must be made common. Multiplication finds a fraction of a fraction; division asks how many groups fit.

KEY VOCABULARY

numerator • denominator • equivalent • improper • mixed number • reciprocal • common denominator

3 shaded equal parts out of 8 = 3/8

Why the method works

- Multiplying numerator and denominator by the same non-zero number multiplies the fraction by 1, so its value is unchanged.
- For addition, only equal-sized parts can be counted together.
- Dividing by a fraction is multiplying by its reciprocal because the reciprocal rescales the divisor to 1.
- Always simplify by dividing numerator and denominator by their HCF.

CHECK BEFORE MOVING ON

Answer mentally: 1) Simplify 42/63. 2) Convert 3 2/5 to an improper fraction. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because …” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 05 • N2, N8, N10, N12 • METHODS

N2, N8, N10, N12

Fractions: meaning, equivalence and calculation — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Convert mixed numbers to improper fractions before multiplication or division.
- For + or −, find a common denominator and change numerators consistently.
- For ×, multiply numerators and denominators, cancelling common factors early.
- For ÷, keep the first fraction, change to multiplication, flip the second.

WORKED EXAMPLE 1

Calculate 5/6 − 3/8.

1. LCM(6,8)=24.
2. 5/6=20/24 and 3/8=9/24.
3. Subtract numerators.

ANSWER: 11/24

WORKED EXAMPLE 2

Calculate 2 1/4 ÷ 3/5.

1. 2 1/4=9/4.
2. Multiply by reciprocal 5/3.
3. Cancel and multiply.

ANSWER: 15/4=3 3/4

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes it easier to repair errors.

GUIDED TRY

Calculate 2/3+5/12. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 05 • N2, N8, N10, N12 • APPLICATION

N2, N8, N10, N12

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

A recipe uses 3/4 litre for 6 portions. For 10 portions multiply by 10/6: 3/4×10/6=5/4=1.25 litres. The scale factor changes the whole recipe, not just one ingredient.

Common mistakes and how to repair them

MISTAKE 1

Adding denominators. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Cancelling across addition. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Flipping the first fraction instead of the divisor. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

A tank is 5/8 full. After using 1/4 of the tank, what fraction remains? Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 05 • N2, N8, N10, N12 • PRACTICE

N2, N8, N10, N12

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. **Simplify 42/63.**

2. **Convert 3 2/5 to an improper fraction.**

3. **Calculate 2/3+5/12.**

4. **Calculate 7/8−1/6.**

5. **Calculate 4/9×15/8.**

6. **Calculate 5/6÷10/21.**

7. **Find 3/7 of 280.**

8. **A tank is 5/8 full. After using 1/4 of the tank, what fraction remains?**

REFLECTION

Circle one: secure / almost / reteach. Write the question number of your most useful error and the rule that repairs it.

CHAPTER 06 • N1, N2, N10

N1, N2, N10

Decimals and conversion between forms

Use place value to connect decimals, fractions and percentages.

SPECIFICATION FOCUS

Pearson Edexcel content references N1, N2, N10. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

A terminating decimal is a fraction whose denominator can be expressed using factors of 2 and 5 after simplification. Decimal calculation follows integer calculation with careful place-value alignment. Fractions, decimals and percentages are different representations of the same proportion.

KEY VOCABULARY

decimal point • tenth • hundredth • thousandth • terminating • recurring • proportion

100s	10s	1s	.	tenths	hundredths	thousandths
4	0	7	.	3	0	5

Why the method works

- 0.37 means 37 hundredths, so 0.37=37/100.
- Multiplying by 10 shifts every digit one place into a position ten times as valuable; the decimal point itself does not “move”.
- A percentage is a fraction out of 100, so decimal to percentage multiplies by 100.
- For comparison, convert all values to a single convenient form.

CHECK BEFORE MOVING ON

Answer mentally: 1) Calculate 8.6+0.745. 2) Calculate 12−3.086. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because …” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 06 • N1, N2, N10 • METHODS

N1, N2, N10

Decimals and conversion between forms — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Align decimal points for addition and subtraction.
- Ignore decimal points temporarily for multiplication, then restore place value by counting decimal places.
- For division by a decimal, scale both numbers by the same power of 10 to make the divisor whole.
- Simplify fractions after writing a decimal over a power of 10.

WORKED EXAMPLE 1

Calculate 7.04−2.875.

1. Write 7.040 so place values align.
2. Subtract column by column.

ANSWER: 4.165

WORKED EXAMPLE 2

Write 0.375 as a fraction and percentage.

1. 0.375=375/1000.
2. Simplify by 125 to get 3/8.
3. Multiply decimal by 100 for percentage.

ANSWER: 3/8 and 37.5%

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes it easier to repair errors.

GUIDED TRY

Calculate 0.48×0.7. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 06 • N1, N2, N10 • APPLICATION

N1, N2, N10

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

A fuel display shows 7.6 litres used over 95 km. The rate is $7.6 \div 95 = 0.08$ litres per km, or 8 litres per 100 km. Units explain what the decimal represents.

Common mistakes and how to repair them

MISTAKE 1

Aligning the final digits instead of decimal points. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Saying $0.5 < 0.47$ because $5 < 47$. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Moving only one decimal point when scaling a division. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Order 0.6, 59%, 5/8. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 06 • N1, N2, N10 • PRACTICE

N1, N2, N10

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. **Calculate 8.6+0.745.**

2. **Calculate 12−3.086.**

3. **Calculate 0.48×0.7.**

4. **Calculate 6.3÷0.09.**

5. **Write 0.28 as a simplified fraction.**

6. **Write 7/20 as a decimal.**

7. **Write 0.045 as a percentage.**

8. **Order 0.6, 59%, 5/8.**

REFLECTION

Circle one: secure / almost / reteach. Write the question number of your most useful error and the rule that repairs it.

CHAPTER 07 • N12, R9

N12, R9

Percentages, multipliers and percentage change

A multiplier keeps the entire percentage change in one calculation.

SPECIFICATION FOCUS

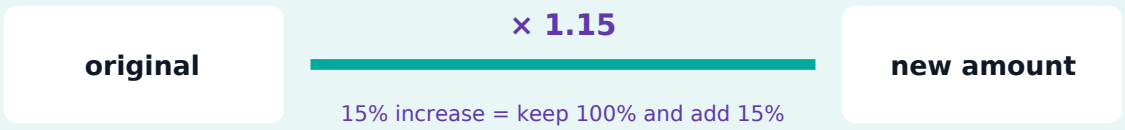
Pearson Edexcel content references N12, R9. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

Percent means “per hundred”. Percentage methods become reliable when the original amount is identified first. A multiplier combines the original 100% with the change: a 12% increase uses 112%=1.12, while a 12% decrease uses 88%=0.88.

KEY VOCABULARY

percentage • original • change • multiplier • increase • decrease • reverse percentage



Why the method works

- Percentage of amount = percentage/100 × amount.
- Percentage change compares the change with the original, not the final amount.
- Successive changes multiply; equal percentage increase and decrease do not cancel.
- For a reverse percentage, divide by the multiplier because the final amount is already the multiplied result.

CHECK BEFORE MOVING ON

Answer mentally: 1) Find 18% of 350. 2) Increase £480 by 7%. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because …” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 07 • N12, R9 • METHODS

N12, R9

Percentages, multipliers and percentage change — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Identify the original or base amount.
- Convert the percentage to a decimal multiplier.
- Multiply for a forward change; divide for a reverse change.
- For percentage change, calculate difference÷original×100%.

WORKED EXAMPLE 1

A £640 laptop is reduced by 15%. Find the sale price.

1. 15% decrease keeps 85%.
2. Multiplier=0.85.
3. 640×0.85=544.

ANSWER: £544

WORKED EXAMPLE 2

After a 20% increase, a salary is £30,000. Find the original.

1. Final=original×1.20.
2. Original=30,000÷1.20.

ANSWER: £25,000

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes it easier to repair errors.

GUIDED TRY

Decrease 860 kg by 12%. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 07 • N12, R9 • APPLICATION

N12, R9

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

A price rises 10% then falls 10%. The combined multiplier is $1.10\times0.90=0.99$, so the final price is 99% of the original: a 1% decrease.

Common mistakes and how to repair them

MISTAKE 1

Dividing change by the new amount. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Subtracting 15 rather than 15%. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Adding successive percentage changes without checking multipliers. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Explain why +20% then −20% is not zero change. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 07 • N12, R9 • PRACTICE

N12, R9

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. **Find 18% of 350.**

2. **Increase £480 by 7%.**

3. **Decrease 860 kg by 12%.**

4. **A value rises from 240 to 294. Find percentage increase.**

5. **A £72 item is reduced to £54. Find percentage decrease.**

6. **After a 25% increase, a price is £90. Find the original.**

7. **Apply a 10% rise then a 20% rise to £500.**

8. **Explain why +20% then −20% is not zero change.**

REFLECTION

Circle one: secure / almost / reteach. Write the question number of your most useful error and the rule that repairs it.

CHAPTER 08 • N9

Standard form and calculator interpretation

Standard form separates size from significant digits.

SPECIFICATION FOCUS

Pearson Edexcel content references N9. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

Standard form writes a non-zero number as $A \times 10^n$ where $1 \leq A < 10$ and n is an integer. The power records place-value movement. It is useful for very large and very small measurements and makes order-of-magnitude comparisons visible.

KEY VOCABULARY

standard form • coefficient • power of ten • exponent • order of magnitude

$$4.7 \times 10^5 = 470{,}000$$

positive power → move decimal point right

1 ≤ first number < 10

Why the method works

- A positive exponent represents repeated multiplication by 10.
- A negative exponent represents division by a power of 10.
- The coefficient must be at least 1 but less than 10.
- For multiplication, multiply coefficients and add powers; then normalise the coefficient if needed.

CHECK BEFORE MOVING ON

Answer mentally: 1) Write 6,200,000 in standard form. 2) Write 0.00093 in standard form. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because …” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 08 • N9 • METHODS

Standard form and calculator interpretation — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Place the decimal point after the first non-zero digit.
- Count places from the original position to the new position.
- Use a positive index for numbers at least 10 and a negative index for numbers between 0 and 1.
- Read calculator notation such as 4.7E5 as 4.7×10^{5}.

WORKED EXAMPLE 1

Write 0.0000725 in standard form.

1. Move the decimal point to make 7.25.
2. It moved 5 places right, so the original is divided by 10^{5}.

ANSWER: 7.25×10^{-5}

WORKED EXAMPLE 2

Calculate $(3\times10^{4})(6\times10^{3})$.

1. Multiply coefficients: 18.
2. Add indices: 10^{7}.
3. Normalise 18×10^{7}.

ANSWER: 1.8×10^{8}

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes it easier to repair errors.

GUIDED TRY

Write 4.08×10^{6} as an ordinary number. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 08 • N9 • APPLICATION

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

Astronomers compare distances such as 1.5×10^{8} km and 4.0×10^{5} km. Comparing powers first shows the first distance is hundreds of times larger before exact division.

Common mistakes and how to repair them

MISTAKE 1

Leaving 18×10^{7} without normalising. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Using a positive power for a small decimal. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Typing ×10^ incorrectly when the calculator has an EXP/EE key. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

A cell is 3.4×10^{-5} m long. Find the length of 200 cells. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 08 • N9 • PRACTICE

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. **Write 6,200,000 in standard form.**

2. **Write 0.00093 in standard form.**

3. **Write 4.08×10^{6} as an ordinary number.**

4. **Write 7.2×10^{-4} as an ordinary number.**

5. **Calculate $(2\times10^{5})(4\times10^{3})$.**

6. **Calculate $(9\times10^{7})\div(3\times10^{2})$.**

7. **Order 5×10^{4}, 8×10^{3}, 1.2×10^{5}.**

8. **A cell is 3.4×10^{-5} m long. Find the length of 200 cells.**

REFLECTION

Circle one: secure / almost / reteach. Write the question number of your most useful error and the rule that repairs it.

CHAPTER 09 • N14-N16

N14, N15, N16

Rounding, estimation and accuracy

Rounding chooses the nearest permitted value and records the precision.

SPECIFICATION FOCUS

Pearson Edexcel content references N14, N15, N16. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

A rounded value represents an interval of possible original values. The deciding digit is immediately to the right of the required place. Estimation replaces awkward values with convenient nearby values so that size and reasonableness can be judged quickly.

KEY VOCABULARY

decimal place • significant figure • approximation • estimate • lower bound • upper bound • error interval

3.472 lies above 3.45, so it rounds to 3.5 to 1 decimal place

Why the method works

- Decimal places count positions after the decimal point; significant figures begin at the first non-zero digit.
- The halfway point separates values rounding down from values rounding up.
- A lower bound is included but an upper bound is normally excluded.
- An estimate is not random rounding: choose values that keep the calculation useful.

CHECK BEFORE MOVING ON

Answer mentally: 1) Round 47.386 to 2 d.p. 2) Round 0.005827 to 2 s.f. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because …” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 09 • N14-N16 • METHODS

N14, N15, N16

Rounding, estimation and accuracy — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Underline the last digit to be retained.
- Inspect the next digit: 0–4 keep, 5–9 increase.
- Replace following digits with zeros for whole-number rounding or remove them after a decimal.
- For an error interval, add and subtract half the rounding unit.

WORKED EXAMPLE 1

Round 0.07846 to 3 significant figures.

1. First significant digit is 7.
2. Keep 7,8,4; next digit is 6, so 4 rounds to 5.

ANSWER: 0.0785

WORKED EXAMPLE 2

A length is 8.4 cm to the nearest 0.1 cm. Write its error interval.

1. Half of 0.1 is 0.05.
2. Lower=8.35; upper=8.45.

ANSWER: $8.35 \leq L < 8.45$

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes it easier to repair errors.

GUIDED TRY

Round 684,921 to 3 s.f. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 09 • N14-N16 • APPLICATION

N14, N15, N16

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

Estimate $19.8\times4.12\div0.51$ as $20\times4\div0.5=160$. A calculator answer near 16 or 1,600 is therefore implausible. Estimation is a quality-control tool.

Common mistakes and how to repair them

MISTAKE 1

Counting leading zeros as significant figures. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Writing ≤ at the upper end of an error interval. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Rounding intermediate values too early. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Explain why 0.0498 rounds to 0.050 to 2 s.f. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 09 • N14-N16 • PRACTICE

N14, N15, N16

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. **Round 47.386 to 2 d.p.**

2. **Round 0.005827 to 2 s.f.**

3. **Round 684,921 to 3 s.f.**

4. **Estimate 51.2×9.8.**

5. **Estimate 398÷0.204.**

6. **Write the interval for 26 kg to the nearest kg.**

7. **Write the interval for 3.7 m to the nearest 0.1 m.**

8. **Explain why 0.0498 rounds to 0.050 to 2 s.f.**

REFLECTION

Circle one: secure / almost / reteach. Write the question number of your most useful error and the rule that repairs it.

CHAPTER 10 • N3, N5

N3, N5

Calculator strategy, systematic listing and mixed problem solving

Model the situation, preserve accuracy and prove that your result is complete.

SPECIFICATION FOCUS

Pearson Edexcel content references N3, N5. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

A multi-step question is solved by translating words into a chain of mathematical decisions. A calculator performs arithmetic but does not choose operations, units, accuracy or interpretation. Systematic listing is a proof of completeness: outcomes are organised so none are omitted or repeated.

KEY VOCABULARY

model • assumption • systematic • outcome • estimate • unit • interpretation

A reliable solution is a chain of decisions, not only a calculator display.

Why the method works

- Writing the calculation before entering it prevents “calculator-only” solutions.
- Brackets ensure the calculator follows the intended structure.
- Keeping full accuracy until the end prevents accumulated rounding error.
- A systematic list changes one feature at a time and applies restrictions explicitly.

CHECK BEFORE MOVING ON

Answer mentally: 1) Evaluate $(7.4^2+3.8)\div 2.6$ to 3 s.f. 2) A journey is 84 km at 56 km/h. Find time in minutes. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because …” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 10 • N3, N5 • METHODS

N3, N5

Calculator strategy, systematic listing and mixed problem solving — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Underline quantities, units and the exact question.
- Choose a representation: calculation, table, number line, diagram or organised list.
- Estimate the expected size.
- Calculate with full accuracy, then round once.
- Check units and interpret the result in context.

WORKED EXAMPLE 1

A car travels 168 km using 12.6 litres. Find km per litre and estimate fuel for 450 km.

1. Rate=168÷12.6=13.333... km/L.
2. Fuel=450÷13.333...=33.75.
3. Round appropriately for the context.

ANSWER: 33.8 litres

WORKED EXAMPLE 2

How many three-digit even numbers can be made from 1,2,3,4 without repetition?

1. Last digit must be 2 or 4.
2. For each ending, 3 choices remain for hundreds and 2 for tens.
3. 2×3×2=12.

ANSWER: 12

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes it easier to repair errors.

GUIDED TRY

A pack of 18 costs £7.65. Find cost per item. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 10 • N3, N5 • APPLICATION

N3, N5

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

A £2,400 loan charges 3.5% simple interest each year for 4 years plus a £60 fee. Interest=2400×0.035×4=£336; total=2400+336+60=£2,796. Every term in the model has a contextual meaning.

Common mistakes and how to repair them

MISTAKE 1

Rounding a rate before using it in the next step. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Ignoring units when converting minutes to hours. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Listing outcomes randomly and assuming the list is complete. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Write one assumption in a constant-speed journey model. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 10 • N3, N5 • PRACTICE

N3, N5

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. **Evaluate $(7.4^2+3.8)\div 2.6$ to 3 s.f.**

2. **A journey is 84 km at 56 km/h. Find time in minutes.**

3. **A pack of 18 costs £7.65. Find cost per item.**

4. **A £1,800 investment earns 4% simple interest for 3 years. Find total.**

5. **Using digits 2,3,5,7, list all two-digit multiples of 5 without repetition.**

6. **How many outfits from 4 shirts and 3 trousers?**

7. **A 2.4 kg bag is shared in 75 g portions. How many complete portions?**

8. **Write one assumption in a constant-speed journey model.**

REFLECTION

Circle one: secure / almost / reteach. Write the question number of your most useful error and the rule that repairs it.

CHAPTER 11 • N8, N10, N12

N8, N10, N12

Exact calculation, terminating decimals and numerical operators

Keep fractions and multiples of pi exact until approximation is requested.

SPECIFICATION FOCUS

Pearson Edexcel content references N8, N10, N12. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

An exact value records a quantity without rounding. Fractions and multiples of pi often give exact answers, while calculator decimals may be approximations. A terminating decimal has a finite number of digits and can be converted to a fraction with a power of ten as denominator. Fractions and percentages also act as operators: they tell us to multiply an amount by a numerical factor.

KEY VOCABULARY

exact • approximation • terminating decimal • operator • numerator • denominator • multiple of pi

3 shaded equal parts out of 8 = 3/8

Why the method works

- A terminating decimal can be written over 10, 100, 1000 or another power of ten.
- Leaving pi in an answer avoids premature rounding.
- Multiplying by a fraction applies that fraction as an operator.
- Exact forms can be substituted into later calculations without accumulated rounding error.

CHECK BEFORE MOVING ON

Answer mentally: 1) Write 0.48 as a fraction simply. 2) Write 7/20 as a decimal. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because …” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 11 • N8, N10, N12 • METHODS

N8, N10, N12

Exact calculation, terminating decimals and numerical operators — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Identify whether an exact or decimal answer is required.
- Convert terminating decimals using place value and simplify.
- Apply a fraction or percentage by multiplication.
- Round only the final result when the question specifies accuracy.

WORKED EXAMPLE 1

Write 0.375 as a fraction in simplest form.

1. 0.375=375/1000.
2. Divide numerator and denominator by 125.

ANSWER: 3/8

WORKED EXAMPLE 2

A semicircle has radius 6 cm. Find its exact perimeter.

1. Half-circumference=6π.
2. Add diameter 12.

ANSWER: 12+6π cm

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes it easier to repair errors.

GUIDED TRY

Calculate 5/8 of 96. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 11 • N8, N10, N12 • APPLICATION

N8, N10, N12

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

Engineering calculations often preserve pi or fractions through several stages. A rounded intermediate circumference can change a later cost or tolerance result.

Common mistakes and how to repair them

MISTAKE 1

Replacing pi by 3.14 when an exact answer is requested. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Forgetting the straight diameter in a semicircle perimeter. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Treating “three quarters of” as division by three quarters. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Explain difference between 2π and decimal 6.28. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 11 • N8, N10, N12 • PRACTICE

N8, N10, N12

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. **Write 0.48 as a fraction simply.**

2. **Write 7/20 as a decimal.**

3. **Calculate 5/8 of 96.**

4. **Calculate 35% of 240.**

5. **Write 3π+7π simply.**

6. **Circle radius 4 cm: exact circumference.**

7. **Circle radius 3 cm: exact area.**

8. **Explain difference between 2π and decimal 6.28.**

REFLECTION

Circle one: secure / almost / reteach. Write the question number of your most useful error and the rule that repairs it.

CHAPTER 12 • N13

Units, conversions and compound measures

Convert quantities before combining them and let units guide the operation.

SPECIFICATION FOCUS

Pearson Edexcel content references N13. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

Measurement numbers have meaning only with units. Metric conversions follow powers of ten, but area conversions square the length factor and volume conversions cube it. Compound units such as kilometres per hour, pounds per kilogram and grams per cubic centimetre describe one quantity per unit of another.

KEY VOCABULARY

metric • conversion factor • area unit • volume unit • compound unit • rate • capacity

A reliable solution is a chain of decisions, not only a calculator display.

Why the method works

- A length conversion factor k becomes k^2 for area and k^3 for volume.
- The word “per” indicates division.
- Compatible units are required before adding, subtracting or forming a ratio.
- One litre equals 1000 cm^3 because a litre is a cubic decimetre.

CHECK BEFORE MOVING ON

Answer mentally: 1) Convert 3.7 km to m. 2) Convert 4500 g to kg. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because …” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 12 • N13 • METHODS

Units, conversions and compound measures — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Write the conversion relationship.
- Decide whether the measure is linear, square or cubic.
- Convert all quantities to compatible units.
- Calculate and write the complete compound unit.

WORKED EXAMPLE 1

Convert 2.4 m² to cm².

1. 1 m=100 cm, so 1 m²=10,000 cm².
2. 2.4×10,000.

ANSWER: 24,000 cm²

WORKED EXAMPLE 2

A 750 g pack costs £4.50. Find price per kilogram.

1. 750 g=0.75 kg.
2. 4.50÷0.75.

ANSWER: £6 per kg

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes it easier to repair errors.

GUIDED TRY

Convert 2.5 L to cm³. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 12 • N13 • APPLICATION

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

Building estimates combine lengths, areas, volumes and unit prices. Converting 3 m to 300 cm is valid, but converting 3 m² to 300 cm² is not because both dimensions scale.

Common mistakes and how to repair them

MISTAKE 1

Using the length factor for area or volume. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Combining minutes with an hourly rate without conversion. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Dropping the denominator unit from a rate. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Explain why 1 m² is 10,000 cm². Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 12 • N13 • PRACTICE

N13

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. **Convert 3.7 km to m.**

2. **Convert 4500 g to kg.**

3. **Convert 2.5 L to cm³.**

4. **Convert 0.8 m² to cm².**

5. **Convert 3 m³ to cm³.**

6. **£7.20 for 1.5 kg: price/kg.**

7. **180 km in 2.5 h: average speed.**

8. **Explain why 1 m² is 10,000 cm².**

REFLECTION

Circle one: secure / almost / reteach. Write the question number of your most useful error and the rule that repairs it.

CHAPTER 13 • N15-N16

N15, N16

Error intervals, bounds and limits of accuracy

A rounded measurement represents a range, not one exact original value.

SPECIFICATION FOCUS

Pearson Edexcel content references N15, N16. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

If a value is rounded to a stated unit, the true value lies from half a rounding unit below to half a unit above. The lower bound is included; the upper bound is excluded because that endpoint rounds to the next stated value. Limits of accuracy use these bounds to find the smallest or largest possible result of a calculation.

KEY VOCABULARY

rounded value • rounding unit • error interval • lower bound • upper bound • limit of accuracy

3.472 lies above 3.45, so it rounds to 3.5 to 1 decimal place

Why the method works

- Half the rounding unit locates the two rounding boundaries.
- The interval is lower≤x<upper.
- For positive quantities, a largest sum uses upper bounds and a smallest difference uses lower first minus upper second.
- A bound calculation should not round inputs again.

CHECK BEFORE MOVING ON

Answer mentally: 1) 42 cm nearest cm: interval. 2) 3.7 kg nearest 0.1 kg: interval. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because …” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 13 • N15-N16 • METHODS

N15, N16

Error intervals, bounds and limits of accuracy — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Identify the rounding unit.
- Add and subtract half that unit.
- Write the error interval with an open upper endpoint.
- Select bounds that maximise or minimise the requested positive expression.

WORKED EXAMPLE 1

A length is 8.4 cm to nearest 0.1 cm. Write its interval.

1. Half-unit=0.05 cm.
2. Lower=8.35; upper=8.45.

ANSWER: $8.35 \leq L < 8.45$

WORKED EXAMPLE 2

A=12 cm and B=5 cm, each nearest cm. Find lower bound for A−B.

1. A lower=11.5; B upper=5.5.
2. Lowest difference=11.5−5.5.

ANSWER: 6 cm

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes it easier to repair errors.

GUIDED TRY

250 m nearest 10 m: lower bound. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 13 • N15-N16 • APPLICATION

N15, N16

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

Manufacturing tolerances decide whether parts will fit in the worst case. Nominal dimensions alone can hide a possible maximum or minimum clearance.

Common mistakes and how to repair them

MISTAKE 1

Including the upper bound. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Using ±1 instead of half the rounding unit. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Choosing both lower bounds for a smallest difference. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Explain why upper endpoint is excluded. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 13 • N15-N16 • PRACTICE

N15, N16

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. **42 cm nearest cm: interval.**

2. **3.7 kg nearest 0.1 kg: interval.**

3. **250 m nearest 10 m: lower bound.**

4. **Same: upper bound.**

5. **a=8,b=3 nearest integers: upper bound a+b.**

6. **Same: lower bound a−b.**

7. **Length 6.2,width 4.1 nearest 0.1: lower-bound area.**

8. **Explain why upper endpoint is excluded.**

REFLECTION

Circle one: secure / almost / reteach. Write the question number of your most useful error and the rule that repairs it.

PRACTICE ANSWERS

CHAPTER 01

Practice answers and repair notes

Place value, ordering and directed numbers

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Write 6,040,709 in words. **ANSWER: six million forty thousand seven hundred and nine**

Method cue: Write numbers in aligned place-value columns. Then check the sign, size, accuracy and units of the result.

2. What is the value of 8 in 3.081? **ANSWER: 0.08**

Method cue: Convert fractions or percentages to decimals only when comparison requires it. Then check the sign, size, accuracy and units of the result.

3. Insert < or >: −7 ___ −2. **ANSWER: −7 < −2**

Method cue: Use < for “less than” and > for “greater than”; the open side faces the larger number. Then check the sign, size, accuracy and units of the result.

4. Order 0.45, 43%, 1/2, 0.405. **ANSWER: 0.405, 43%, 0.45, 1/2**

Method cue: For a change, final − initial gives a signed result. Then check the sign, size, accuracy and units of the result.

5. Calculate the change from −6 to 11. **ANSWER: 17**

Method cue: Write numbers in aligned place-value columns. Then check the sign, size, accuracy and units of the result.

6. A lift travels from floor 4 to floor −3. How many floors? **ANSWER: 7**

Method cue: Convert fractions or percentages to decimals only when comparison requires it. Then check the sign, size, accuracy and units of the result.

7. Write the integer halfway between −9 and 5. **ANSWER: −2**

Method cue: Use < for “less than” and > for “greater than”; the open side faces the larger number. Then check the sign, size, accuracy and units of the result.

8. Explain why −0.8 < −0.35. **ANSWER: −0.8 lies farther left**

Method cue: For a change, final − initial gives a signed result. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 02

Practice answers and repair notes

Four operations, inverse operations and BIDMAS

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Calculate $7+4\times6$. **ANSWER: 31**

Method cue: Work inside brackets first. Then check the sign, size, accuracy and units of the result.

2. Calculate $(18-5)\times3$. **ANSWER: 39**

Method cue: Evaluate indices such as squares and cubes. Then check the sign, size, accuracy and units of the result.

3. Calculate $48\div6\times2$. **ANSWER: 16**

Method cue: Perform division and multiplication from left to right. Then check the sign, size, accuracy and units of the result.

4. Calculate $5^2-3\times4$. **ANSWER: 13**

Method cue: Perform addition and subtraction from left to right. Then check the sign, size, accuracy and units of the result.

5. Work out $-7+12-9$. **ANSWER: -4**

Method cue: Check using the inverse operation or an estimate. Then check the sign, size, accuracy and units of the result.

6. Work out $-6\times(-4)$. **ANSWER: 24**

Method cue: Work inside brackets first. Then check the sign, size, accuracy and units of the result.

7. A £240 phone is paid in 8 equal instalments plus a £5 fee each month. Find the monthly payment. **ANSWER: £35**

Method cue: Evaluate indices such as squares and cubes. Then check the sign, size, accuracy and units of the result.

8. Use an inverse operation to check $672\div21=32$. **ANSWER: $32\times21=672$**

Method cue: Perform division and multiplication from left to right. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 03

Practice answers and repair notes

Factors, multiples, primes, HCF and LCM

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. List all factors of 36. **ANSWER: 1,2,3,4,6,9,12,18,36**

Method cue: Divide by the smallest possible prime repeatedly. Then check the sign, size, accuracy and units of the result.

2. Write the first five multiples of 14. **ANSWER: 14,28,42,56,70**

Method cue: Write the factorisation with indices. Then check the sign, size, accuracy and units of the result.

3. Is 91 prime? Explain. **ANSWER: No; 91=7×13**

Method cue: For HCF, select the overlap. Then check the sign, size, accuracy and units of the result.

4. Write 84 as a product of primes. **ANSWER: $2^2 \times 3 \times 7$**

Method cue: For LCM, combine enough factors to contain both numbers. Then check the sign, size, accuracy and units of the result.

5. Find HCF(48,72). **ANSWER: 24**

Method cue: Divide by the smallest possible prime repeatedly. Then check the sign, size, accuracy and units of the result.

6. Find LCM(15,24). **ANSWER: 120**

Method cue: Write the factorisation with indices. Then check the sign, size, accuracy and units of the result.

7. Ribbon lengths 84 cm and 126 cm are cut into the longest equal pieces. Find the piece length. **ANSWER: 42 cm**

Method cue: For HCF, select the overlap. Then check the sign, size, accuracy and units of the result.

8. Buses leave every 20 and 28 minutes. After how many minutes together again? **ANSWER: 140 minutes**

Method cue: For LCM, combine enough factors to contain both numbers. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 04

Practice answers and repair notes

Powers, roots and Foundation index laws

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Evaluate 5^3. **ANSWER: 125**

Method cue: Check that bases match before applying an index law. Then check the sign, size, accuracy and units of the result.

2. Find $\sqrt{225}$. **ANSWER: 15**

Method cue: Evaluate roots by asking which positive number produces the given square or cube. Then check the sign, size, accuracy and units of the result.

3. Find $\sqrt[3]{512}$. **ANSWER: 8**

Method cue: Keep brackets around a negative base: $(-3)^2=9$ but $-3^2=-9$. Then check the sign, size, accuracy and units of the result.

4. Simplify $3^4\times3^2$. **ANSWER: 3^6**

Method cue: Use prime factors to identify exact roots. Then check the sign, size, accuracy and units of the result.

5. Simplify $7^9\div7^5$. **ANSWER: 7^4**

Method cue: Check that bases match before applying an index law. Then check the sign, size, accuracy and units of the result.

6. Simplify $(2^3)^4$. **ANSWER: 2^{12}**

Method cue: Evaluate roots by asking which positive number produces the given square or cube. Then check the sign, size, accuracy and units of the result.

7. Evaluate 2^{-3}. **ANSWER: 1/8**

Method cue: Keep brackets around a negative base: $(-3)^2=9$ but $-3^2=-9$. Then check the sign, size, accuracy and units of the result.

8. A square has area 324 cm². Find its perimeter. **ANSWER: 72 cm**

Method cue: Use prime factors to identify exact roots. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 05

Practice answers and repair notes

Fractions: meaning, equivalence and calculation

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Simplify 42/63. **ANSWER: 2/3**

Method cue: Convert mixed numbers to improper fractions before multiplication or division. Then check the sign, size, accuracy and units of the result.

2. Convert 3 2/5 to an improper fraction. **ANSWER: 17/5**

Method cue: For + or −, find a common denominator and change numerators consistently. Then check the sign, size, accuracy and units of the result.

3. Calculate 2/3+5/12. **ANSWER: 13/12=1 1/12**

Method cue: For ×, multiply numerators and denominators, cancelling common factors early. Then check the sign, size, accuracy and units of the result.

4. Calculate 7/8−1/6. **ANSWER: 17/24**

Method cue: For ÷, keep the first fraction, change to multiplication, flip the second. Then check the sign, size, accuracy and units of the result.

5. Calculate 4/9×15/8. **ANSWER: 5/6**

Method cue: Convert mixed numbers to improper fractions before multiplication or division. Then check the sign, size, accuracy and units of the result.

6. Calculate 5/6÷10/21. **ANSWER: 7/4=1 3/4**

Method cue: For + or −, find a common denominator and change numerators consistently. Then check the sign, size, accuracy and units of the result.

7. Find 3/7 of 280. **ANSWER: 120**

Method cue: For ×, multiply numerators and denominators, cancelling common factors early. Then check the sign, size, accuracy and units of the result.

8. A tank is 5/8 full. After using 1/4 of the tank, what fraction remains? **ANSWER: 3/8**

Method cue: For ÷, keep the first fraction, change to multiplication, flip the second. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 06

Practice answers and repair notes

Decimals and conversion between forms

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Calculate 8.6+0.745. **ANSWER: 9.345**

Method cue: Align decimal points for addition and subtraction. Then check the sign, size, accuracy and units of the result.

2. Calculate 12−3.086. **ANSWER: 8.914**

Method cue: Ignore decimal points temporarily for multiplication, then restore place value by counting decimal places. Then check the sign, size, accuracy and units of the result.

3. Calculate 0.48×0.7. **ANSWER: 0.336**

Method cue: For division by a decimal, scale both numbers by the same power of 10 to make the divisor whole. Then check the sign, size, accuracy and units of the result.

4. Calculate 6.3÷0.09. **ANSWER: 70**

Method cue: Simplify fractions after writing a decimal over a power of 10. Then check the sign, size, accuracy and units of the result.

5. Write 0.28 as a simplified fraction. **ANSWER: 7/25**

Method cue: Align decimal points for addition and subtraction. Then check the sign, size, accuracy and units of the result.

6. Write 7/20 as a decimal. **ANSWER: 0.35**

Method cue: Ignore decimal points temporarily for multiplication, then restore place value by counting decimal places. Then check the sign, size, accuracy and units of the result.

7. Write 0.045 as a percentage. **ANSWER: 4.5%**

Method cue: For division by a decimal, scale both numbers by the same power of 10 to make the divisor whole. Then check the sign, size, accuracy and units of the result.

8. Order 0.6, 59%, 5/8. **ANSWER: 59%, 0.6, 5/8**

Method cue: Simplify fractions after writing a decimal over a power of 10. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 07

Practice answers and repair notes

Percentages, multipliers and percentage change

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Find 18% of 350. **ANSWER: 63**

Method cue: Identify the original or base amount. Then check the sign, size, accuracy and units of the result.

2. Increase £480 by 7%. **ANSWER: £513.60**

Method cue: Convert the percentage to a decimal multiplier. Then check the sign, size, accuracy and units of the result.

3. Decrease 860 kg by 12%. **ANSWER: 756.8 kg**

Method cue: Multiply for a forward change; divide for a reverse change. Then check the sign, size, accuracy and units of the result.

4. A value rises from 240 to 294. Find percentage increase. **ANSWER: 22.5%**

Method cue: For percentage change, calculate difference÷original×100%. Then check the sign, size, accuracy and units of the result.

5. A £72 item is reduced to £54. Find percentage decrease. **ANSWER: 25%**

Method cue: Identify the original or base amount. Then check the sign, size, accuracy and units of the result.

6. After a 25% increase, a price is £90. Find the original. **ANSWER: £72**

Method cue: Convert the percentage to a decimal multiplier. Then check the sign, size, accuracy and units of the result.

7. Apply a 10% rise then a 20% rise to £500. **ANSWER: £660**

Method cue: Multiply for a forward change; divide for a reverse change. Then check the sign, size, accuracy and units of the result.

8. Explain why +20% then −20% is not zero change. **ANSWER: 1.2×0.8=0.96, a 4% decrease**

Method cue: For percentage change, calculate difference÷original×100%. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 08

Practice answers and repair notes

Standard form and calculator interpretation

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Write 6,200,000 in standard form. **ANSWER: 6.2×10^{6}**

Method cue: Place the decimal point after the first non-zero digit. Then check the sign, size, accuracy and units of the result.

2. Write 0.00093 in standard form. **ANSWER: 9.3×10^{-4}**

Method cue: Count places from the original position to the new position. Then check the sign, size, accuracy and units of the result.

3. Write 4.08×10^{6} as an ordinary number. **ANSWER: 4,080,000**

Method cue: Use a positive index for numbers at least 10 and a negative index for numbers between 0 and 1. Then check the sign, size, accuracy and units of the result.

4. Write 7.2×10^{-4} as an ordinary number. **ANSWER: 0.00072**

Method cue: Read calculator notation such as 4.7E5 as 4.7×10^{5}. Then check the sign, size, accuracy and units of the result.

5. Calculate $(2\times10^{5})(4\times10^{3})$. **ANSWER: 8×10^{8}**

Method cue: Place the decimal point after the first non-zero digit. Then check the sign, size, accuracy and units of the result.

6. Calculate $(9\times10^{7})\div(3\times10^{2})$. **ANSWER: 3×10^{5}**

Method cue: Count places from the original position to the new position. Then check the sign, size, accuracy and units of the result.

7. Order 5×10^{4}, 8×10^{3}, 1.2×10^{5}. **ANSWER: 8×10^{3}, 5×10^{4}, 1.2×10^{5}**

Method cue: Use a positive index for numbers at least 10 and a negative index for numbers between 0 and 1. Then check the sign, size, accuracy and units of the result.

8. A cell is 3.4×10^{-5} m long. Find the length of 200 cells. **ANSWER: 6.8×10^{-3} m**

Method cue: Read calculator notation such as 4.7E5 as 4.7×10^{5}. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 09

Practice answers and repair notes

Rounding, estimation and accuracy

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Round 47.386 to 2 d.p. **ANSWER: 47.39**

Method cue: Underline the last digit to be retained. Then check the sign, size, accuracy and units of the result.

2. Round 0.005827 to 2 s.f. **ANSWER: 0.0058**

Method cue: Inspect the next digit: 0–4 keep, 5–9 increase. Then check the sign, size, accuracy and units of the result.

3. Round 684,921 to 3 s.f. **ANSWER: 685,000**

Method cue: Replace following digits with zeros for whole-number rounding or remove them after a decimal. Then check the sign, size, accuracy and units of the result.

4. Estimate 51.2×9.8. **ANSWER: about 500**

Method cue: For an error interval, add and subtract half the rounding unit. Then check the sign, size, accuracy and units of the result.

5. Estimate 398÷0.204. **ANSWER: about 2,000**

Method cue: Underline the last digit to be retained. Then check the sign, size, accuracy and units of the result.

6. Write the interval for 26 kg to the nearest kg. **ANSWER: $25.5 \le m < 26.5$**

Method cue: Inspect the next digit: 0–4 keep, 5–9 increase. Then check the sign, size, accuracy and units of the result.

7. Write the interval for 3.7 m to the nearest 0.1 m. **ANSWER: $3.65 \le L < 3.75$**

Method cue: Replace following digits with zeros for whole-number rounding or remove them after a decimal. Then check the sign, size, accuracy and units of the result.

8. Explain why 0.0498 rounds to 0.050 to 2 s.f. **ANSWER: first digits are 4,9; next 8 rounds 9 upward**

Method cue: For an error interval, add and subtract half the rounding unit. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 10

Practice answers and repair notes

Calculator strategy, systematic listing and mixed problem solving

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Evaluate $(7.4^2+3.8)\div 2.6$ to 3 s.f. **ANSWER: 22.5**

Method cue: Underline quantities, units and the exact question. Then check the sign, size, accuracy and units of the result.

2. A journey is 84 km at 56 km/h. Find time in minutes. **ANSWER: 90 min**

Method cue: Choose a representation: calculation, table, number line, diagram or organised list. Then check the sign, size, accuracy and units of the result.

3. A pack of 18 costs £7.65. Find cost per item. **ANSWER: £0.425 (42.5p)**

Method cue: Estimate the expected size. Then check the sign, size, accuracy and units of the result.

4. A £1,800 investment earns 4% simple interest for 3 years. Find total. **ANSWER: £2,016**

Method cue: Calculate with full accuracy, then round once. Then check the sign, size, accuracy and units of the result.

5. Using digits 2,3,5,7, list all two-digit multiples of 5 without repetition. **ANSWER: 25,35,75**

Method cue: Check units and interpret the result in context. Then check the sign, size, accuracy and units of the result.

6. How many outfits from 4 shirts and 3 trousers? **ANSWER: 12**

Method cue: Underline quantities, units and the exact question. Then check the sign, size, accuracy and units of the result.

7. A 2.4 kg bag is shared in 75 g portions. How many complete portions? **ANSWER: 32**

Method cue: Choose a representation: calculation, table, number line, diagram or organised list. Then check the sign, size, accuracy and units of the result.

8. Write one assumption in a constant-speed journey model. **ANSWER: speed remains constant**

Method cue: Estimate the expected size. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 11

Practice answers and repair notes

Exact calculation, terminating decimals and numerical operators

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Write 0.48 as a fraction simply. **ANSWER: 12/25**

Method cue: Identify whether an exact or decimal answer is required. Then check the sign, size, accuracy and units of the result.

2. Write 7/20 as a decimal. **ANSWER: 0.35**

Method cue: Convert terminating decimals using place value and simplify. Then check the sign, size, accuracy and units of the result.

3. Calculate 5/8 of 96. **ANSWER: 60**

Method cue: Apply a fraction or percentage by multiplication. Then check the sign, size, accuracy and units of the result.

4. Calculate 35% of 240. **ANSWER: 84**

Method cue: Round only the final result when the question specifies accuracy. Then check the sign, size, accuracy and units of the result.

5. Write 3π+7π simply. **ANSWER: 10π**

Method cue: Identify whether an exact or decimal answer is required. Then check the sign, size, accuracy and units of the result.

6. Circle radius 4 cm: exact circumference. **ANSWER: 8π cm**

Method cue: Convert terminating decimals using place value and simplify. Then check the sign, size, accuracy and units of the result.

7. Circle radius 3 cm: exact area. **ANSWER: 9π cm²**

Method cue: Apply a fraction or percentage by multiplication. Then check the sign, size, accuracy and units of the result.

8. Explain difference between 2π and decimal 6.28. **ANSWER: 2π is exact; 6.28 is rounded**

Method cue: Round only the final result when the question specifies accuracy. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 12

Practice answers and repair notes

Units, conversions and compound measures

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Convert 3.7 km to m. **ANSWER: 3700 m**

Method cue: Write the conversion relationship. Then check the sign, size, accuracy and units of the result.

2. Convert 4500 g to kg. **ANSWER: 4.5 kg**

Method cue: Decide whether the measure is linear, square or cubic. Then check the sign, size, accuracy and units of the result.

3. Convert 2.5 L to cm³. **ANSWER: 2500 cm³**

Method cue: Convert all quantities to compatible units. Then check the sign, size, accuracy and units of the result.

4. Convert 0.8 m² to cm². **ANSWER: 8000 cm²**

Method cue: Calculate and write the complete compound unit. Then check the sign, size, accuracy and units of the result.

5. Convert 3 m³ to cm³. **ANSWER: 3,000,000 cm³**

Method cue: Write the conversion relationship. Then check the sign, size, accuracy and units of the result.

6. £7.20 for 1.5 kg: price/kg. **ANSWER: £4.80/kg**

Method cue: Decide whether the measure is linear, square or cubic. Then check the sign, size, accuracy and units of the result.

7. 180 km in 2.5 h: average speed. **ANSWER: 72 km/h**

Method cue: Convert all quantities to compatible units. Then check the sign, size, accuracy and units of the result.

8. Explain why 1 m² is 10,000 cm². **ANSWER: 100×100 square-centimetres**

Method cue: Calculate and write the complete compound unit. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 13

Practice answers and repair notes

Error intervals, bounds and limits of accuracy

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. 42 cm nearest cm: interval. **ANSWER: 41.5≤x<42.5**

Method cue: Identify the rounding unit. Then check the sign, size, accuracy and units of the result.

2. 3.7 kg nearest 0.1 kg: interval. **ANSWER: 3.65≤m<3.75**

Method cue: Add and subtract half that unit. Then check the sign, size, accuracy and units of the result.

3. 250 m nearest 10 m: lower bound. **ANSWER: 245 m**

Method cue: Write the error interval with an open upper endpoint. Then check the sign, size, accuracy and units of the result.

4. Same: upper bound. **ANSWER: 255 m**

Method cue: Select bounds that maximise or minimise the requested positive expression. Then check the sign, size, accuracy and units of the result.

5. a=8,b=3 nearest integers: upper bound a+b. **ANSWER: 12**

Method cue: Identify the rounding unit. Then check the sign, size, accuracy and units of the result.

6. Same: lower bound a−b. **ANSWER: 4**

Method cue: Add and subtract half that unit. Then check the sign, size, accuracy and units of the result.

7. Length 6.2,width 4.1 nearest 0.1: lower-bound area. **ANSWER: 24.2925 square units**

Method cue: Write the error interval with an open upper endpoint. Then check the sign, size, accuracy and units of the result.

8. Explain why upper endpoint is excluded. **ANSWER: it rounds to next value**

Method cue: Select bounds that maximise or minimise the requested positive expression. Then check the sign, size, accuracy and units of the result.

EDITORIAL SIGN-OFF

PUBLICATION EDITION

Independent authorship and release check

Unit 1: Number • Foundation Tier

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