GCSE ONLINE TUTORING

NUMBER / TOPIC GUIDE 07

07

Rounding, estimation and checking

Shared GCSE core

A useful answer has an appropriate level of accuracy. Rounding communicates that accuracy; estimation checks whether a result is plausible. This guide distinguishes an exact value, an approximation and a contextual decision such as rounding up to buy enough materials.

Rounding chooses a nearby value at a stated precision.



UNDERSTAND THE IDEA. EXPLAIN THE METHOD.

Detailed teaching • Worked examples • Discussion • Original practice • Full solutions

Name: _____

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Before you begin

Understand decimal place value, negative numbers and the order of operations.

Your route through this notebook

1. Rounding to places and significant figures
2. Estimating calculations
3. Checking answers and rounding in context

How to use it

Read a lesson, cover the worked solutions and try the examples yourself. Complete its practice page before checking the answers at the back. Finish with the mixed review, then return to any method you could not explain.

YOUR PROGRESS

After each lesson, ask: Can I explain the idea? Can I choose a method? Can I check my result? Record any questions you want to revisit.

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LESSON 1 / UNDERSTAND

Rounding to places and significant figures

Rounding replaces a number by a nearby value at a chosen level of precision. Decimal places count digits to the right of the decimal point. Significant figures begin at the first non-zero digit and count digits that convey the size of the number. Zeros between significant digits count; zeros used only to reach the first non-zero digit do not.

Identify the last digit you will keep, then examine the next digit. For the positive numbers used here, a next digit of 5 or more rounds up, and a next digit below 5 leaves the retained part unchanged. Replace discarded whole-number places with zeros. For negative numbers, think about the nearest marked values on a number line; exact halfway cases require a stated convention.

A reliable method

1. Decide whether the request is for decimal places or significant figures.

2. Mark the final retained place, then inspect only the next digit.

3. If rounding creates a carry, update earlier digits and preserve the requested precision.

Worked example 1

Round 0.004786 to 2 significant figures.

STEP-BY-STEP SOLUTION

The first significant digit is 4. Keep 4 and 7; the next digit is 8, so round 7 up. Answer: 0.0048.

Worked example 2

Round 9.996 to 2 decimal places.

STEP-BY-STEP SOLUTION

Keep hundredths, then inspect the thousandths digit 6. Rounding 9.99 up carries through both 9s, giving 10.00. The zeros show the requested two decimal places.

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LESSON 1 / DISCUSS & PRACTISE

Explain it, then try it

DISCUSSION • TEST THE IDEA

0.0048 has two significant figures but four decimal places. These counts answer different questions. In a written answer such as 3.50, the final zero can communicate precision even though 3.50 and 3.5 have the same numerical value.

Say it in your own words

Explain the key idea to someone else. Use a small example to support your explanation. If you disagree with a claim, show why it fails.

1.1 Round 56.784 to 1 decimal place.

1.2 Round 0.008349 to 3 significant figures.

1.3 Round 78,650 to 2 significant figures.

1.4 Round 2.995 to 2 decimal places.

Check before turning to the answers: is the size sensible, is the notation clear, and have you included any required units?

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LESSON 2 / UNDERSTAND

Estimating calculations

An estimate is a deliberately simplified calculation, used to judge size or make a quick decision. Round inputs to convenient numbers and calculate with those. One significant figure is a useful starting point, but sensible nearby values can give a more informative estimate. An estimate should be marked with approximately equal to, ≈, rather than presented as exact.

Rounding does not guarantee an estimate is above or below the true answer. If one factor increases and another decreases, their effects compete. If every positive factor increases, the product increases. For a positive quotient, increasing the numerator increases the result, while increasing the denominator decreases it. This reasoning helps explain the direction of an estimate.

A reliable method

1. Choose easy nearby values and state them.

2. Preserve the structure of the original calculation, including brackets.

3. Use the estimate to test magnitude, not to claim exact equality.

Worked example 1

Estimate $(19.6 \times 4.12) \div 0.51$.

STEP-BY-STEP SOLUTION

Use $(20 \times 4) \div 0.5 = 80 \div 0.5 = 160$. A calculator answer near 160 is plausible; an answer near 16 is not.

Worked example 2

Explain whether 50×8 overestimates 48×7.6.

STEP-BY-STEP SOLUTION

Both positive factors have been increased, so their product is increased. The estimate 400 is an overestimate.

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LESSON 2 / DISCUSS & PRACTISE

Explain it, then try it

DISCUSSION • TEST THE IDEA

Rounding 0.48 to 0 would destroy a division estimate. Use a suitable scale, such as one significant figure, to retain the important size: 0.48 ≈ 0.5. Estimation needs judgement, not just a mechanical instruction.

Say it in your own words

Explain the key idea to someone else. Use a small example to support your explanation. If you disagree with a claim, show why it fails.

2.1 Estimate 39.7 × 6.12 using 1 significant figure.

2.2 Estimate 598 ÷ 29.6 using convenient whole numbers.

2.3 Estimate (0.197 × 81.2) ÷ 4.08 using 1 significant figure.

2.4 Does 30 ÷ 5 underestimate or overestimate 30 ÷ 4.8? Explain.

Check before turning to the answers: is the size sensible, is the notation clear, and have you included any required units?

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LESSON 3 / UNDERSTAND

Checking answers and rounding in context

Checking should use a different route where possible. An inverse calculation checks arithmetic, substitution checks an equation, and an estimate checks size. Units provide another check: area needs square units and a count of people must be a whole number. No single check guarantees correctness, but several independent checks make mistakes easier to find.

Keep full calculator precision until the final answer unless a problem explicitly asks for rounded intermediate values. Rounding twice can change a result. Context can override ordinary nearest-number rounding: a required number of buses rounds up, while a number of complete items made from a fixed supply rounds down. Money is usually reported to the nearest penny when a final price is requested.

A reliable method

1. Retain unrounded intermediate results.

2. Use an inverse, estimate or unit check.

3. Decide whether the final quantity is continuous, a complete-item count or a minimum required count.

Worked example 1

A room needs 37.2 m of trim sold in 2.5 m lengths. How many lengths must be bought?

STEP-BY-STEP SOLUTION

37.2 ÷ 2.5 = 14.88. Fourteen lengths provide only 35 m, so buy 15. This is rounding up to meet a minimum requirement.

Worked example 2

Show how rounding twice can give a different answer using 2.449.

STEP-BY-STEP SOLUTION

To 1 decimal place directly: 2.4. First rounding to 2 decimal places gives 2.45, then to 1 decimal place gives 2.5. Use the original value for the final rounding.

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LESSON 3 / DISCUSS & PRACTISE

Explain it, then try it

DISCUSSION • TEST THE IDEA

A realistic-looking answer can still be wrong. Check what was asked: 12.4 complete boxes is not a possible count, and a speed written in metres instead of metres per second has the wrong unit.

Say it in your own words

Explain the key idea to someone else. Use a small example to support your explanation. If you disagree with a claim, show why it fails.

3.1 A bill of £47 is split equally between 6 people. Give the mathematical share to the nearest penny.

3.2 A 9.8 m rope makes complete 0.6 m pieces. How many pieces?

3.3 Round 6.749 directly to 1 decimal place.

3.4 A calculator gives 0.024 for 12.1 × 1.98. Explain a useful check.

Check before turning to the answers: is the size sensible, is the notation clear, and have you included any required units?

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MIXED REVIEW / ORIGINAL EXAM-STYLE PRACTICE

Apply your learning • 1

These questions are independently authored, not taken or adapted from past papers. Marks are suggested for self-assessment. Show your method and explain decisions. Use a calculator only where the arithmetic requires it.

R1. Round 0.006795 to 2 significant figures. [2 marks]

R2. Round 39.995 to 2 decimal places. [2 marks]

R3. Estimate (79.1 × 0.296) ÷ 4.12 using 1 significant figure. [3 marks]

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MIXED REVIEW / ORIGINAL EXAM-STYLE PRACTICE

Apply your learning • 2

These questions are independently authored, not taken or adapted from past papers. Marks are suggested for self-assessment. Show your method and explain decisions. Use a calculator only where the arithmetic requires it.

R4. Explain why 20 × 6 overestimates 19.8 × 5.7. [2 marks]

R5. A journey of 213 km uses fuel at 7.4 km per litre. Find litres needed to 1 decimal place. [3 marks]

R6. Tiles cover 0.36 m² each. A floor has area 17 m². Find the minimum number, ignoring cuts and waste. [3 marks]

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SOLUTIONS / LESSON PRACTICE

Check the reasoning

Your layout may differ. Compare the mathematical reasoning as well as the final answer. Correct any error, then reattempt the question without looking.

Lesson 1 • Rounding to places and significant figures

1.1 Round 56.784 to 1 decimal place.

The next digit is 8, so 56.8.

1.2 Round 0.008349 to 3 significant figures.

Keep 8, 3, 4; next digit 9 rounds 4 up: 0.00835.

1.3 Round 78,650 to 2 significant figures.

Keep 7 and 8; next digit 6 gives 79,000.

1.4 Round 2.995 to 2 decimal places.

The next digit is 5, so carry to give 3.00.

Lesson 2 • Estimating calculations

2.1 Estimate 39.7×6.12 using 1 significant figure.

$40 \times 6 = 240$.

2.2 Estimate $598 \div 29.6$ using convenient whole numbers.

$600 \div 30 = 20$.

2.3 Estimate $(0.197 \times 81.2) \div 4.08$ using 1 significant figure.

$(0.2 \times 80) \div 4 = 4$.

2.4 Does $30 \div 5$ underestimate or overestimate $30 \div 4.8$? Explain.

It underestimates: a larger positive divisor gives a smaller quotient. 6 is below the exact result 6.25.

Lesson 3 • Checking answers and rounding in context

3.1 A bill of £47 is split equally between 6 people. Give the mathematical share to the nearest penny.

$47 \div 6 = 7.8333\ldots$, so £7.83 per person to the nearest penny. Six such rounded shares total £46.98; settling the exact bill needs a 2p adjustment.

3.2 A 9.8 m rope makes complete 0.6 m pieces. How many pieces?

$9.8 \div 0.6 = 16.333\ldots$, so 16 complete pieces.

3.3 Round 6.749 directly to 1 decimal place.

The hundredths digit is 4, so 6.7. Do not first round to 6.75.

3.4 A calculator gives 0.024 for 12.1×1.98. Explain a useful check.

$12 \times 2 \approx 24$, so 0.024 has the wrong magnitude. The exact product is 23.958.

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SOLUTIONS / MIXED REVIEW

Answers and marking guidance

Award the suggested method marks for valid working, even where a later arithmetic slip occurs. Do not count the same step twice. These are independent teaching allocations, not official exam-board mark schemes.

R1. Round 0.006795 to 2 significant figures. [2 marks]

Keep 6 and 7; the next digit is 9, so 0.0068. [1 for identifying places; 1 for result.]

R2. Round 39.995 to 2 decimal places. [2 marks]

40.00. [1 for carrying correctly; 1 for preserving 2 decimal places.]

R3. Estimate (79.1 × 0.296) ÷ 4.12 using 1 significant figure. [3 marks]

(80 × 0.3) ÷ 4 = 6. [1 for rounded inputs; 1 for structure; 1 for result.]

R4. Explain why 20 × 6 overestimates 19.8 × 5.7. [2 marks]

Both positive factors have been increased, so the product increases. [1 for identifying both increases; 1 for their effect.]

R5. A journey of 213 km uses fuel at 7.4 km per litre. Find litres needed to 1 decimal place. [3 marks]

213 ÷ 7.4 = 28.7837... , so 28.8 litres. [1 for division model; 1 for unrounded result; 1 for rounding/unit.]

R6. Tiles cover 0.36 m² each. A floor has area 17 m². Find the minimum number, ignoring cuts and waste. [3 marks]

17 ÷ 0.36 = 47.222... . Buy 48 tiles. [1 for division; 1 for quotient; 1 for contextual rounding.]

Reflect, repair and revisit

Record one secure method, one mistake you corrected and one question to retry. Reattempt the questions you missed in a few days. Explain why your new method works before you compare your answer.

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