Writing Ratios a:b in Simplest Form

Teacher		**Class**	Year 7
Subject	Maths	**Topic**	Ratio
Date		**Room**	
Lesson length	60 minutes	**Country**	United Kingdom

Pupils learn to write ratios in the correct order and reduce them to simplest form. They crack money puzzles by changing to the same units first.

Curriculum links

- use ratio notation, including reduction to simplest form [1]

Learning objectives

- Students will write two quantities as a:b in the correct order without units.
- Students will change quantities to the same units before writing a ratio.
- Students will reduce ratios to simplest form using the highest common factor.

Success criteria

- I can write a:b in the correct order using whole numbers with no units.
- I can change to the same units first when the units do not match.
- I can divide both parts by their highest common factor to simplify.

What students already know

Hold up 3 blue pens and 2 red pens. Ask pupils to say the comparison as blue to red and red to blue. Listen for correct order and use of colon.

Key words

ratio	a way of showing how much of one thing there is compared with another [4]
order	which quantity is written first and which is written second [4]
units	what you measure in, such as pence, pounds or millilitres [3]
equivalent	different pairs of numbers that show the same comparison [9]
highest common factor	the biggest number that divides exactly into both numbers [9]
simplest form	the smallest whole numbers that still keep the same comparison [9]

Materials

- Replica coins and notes
- Strip showing £1 = 100p
- Mini-whiteboards and pens
- Slides 1-12 with projector and speakers
- Printed Worksheet Tasks B-C, one per pupil
- Squared paper and rulers

Before the lesson

- Print Worksheet Tasks B-C, one per pupil, plus a few spare pre-filled pounds-to-pence lines
- Test Slide 6 Video clip 1 and Slide 8 Video clip 4 for sound and picture
- Set out replica coins and notes and £1 = 100p strips on tables
- Clear walkways and check mini-whiteboards and pens work

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Lesson outline

0–8 min **Starter** 8 min · Whole class

Hook pupils with the money trap and recall that order matters in a ratio.

YOU DO

1. Show Slide 1 title then Slide 2 mystery and read the hook: Is 15p to £3 really 15:3? Spot the trap.
2. Hold up a 15p pile of replica coins next to replica £3 and ask pupils to vote on mini-whiteboards if 15:3 is correct.
3. Explain that the units must match or the comparison will be wrong [3], and that today the goal is to convert money to the same units before writing a ratio.
4. Link to Slide 2 drink: 1 part orange to 4 parts water, ratio 1:4, and stress changing the order changes the proportions [4].

STUDENTS DO

1. Look at the coins and Slide 2 and discuss with a partner why 15:3 looks wrong.
2. Hold up mini-whiteboards with trap or no trap and explain which units do not match.

Say: Is 15p to £3 really 15:3? Spot the trap. A ratio shows how much of one thing there is compared to another [4]. Today we will write it with a colon, with no units, in the correct order.

Ask: Why is 15p to £3 not 15:3? (The units are different, pence and pounds, so we must use the same units first [3].) · If orange to water is 1:4, what is water to orange? (4:1, because changing the order changes the proportions [4].)

Check understanding: Scan whiteboards for trap and reason about units. If unsure, model £1 = 100p on the strip and re-ask.

Support: Point to the £1 = 100p strip and ask: how many pence in £3? **Stretch:** Ask what £3 to 15p would be and why the order gives a very different ratio.

Use: Slides 1-2

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8–20 min **Teaching: writing a ratio** 12 min · Whole class

Model how to write part-to-part and part-to-whole ratios in the correct order.

YOU DO

1. Talk through Slide 3 steps: count first quantity, write colon with no gaps and no units, then second quantity in order.
2. Use Slide 4 cards to contrast part-to-part, blue to red paint 3:2, with part-to-whole, orange to whole drink 1:5.
3. Play Video clip 1 on Slide 6, asking pupils to listen for how 3 to 2 is written as 3:2 and why order changes meaning.
4. Model Slide 5 question: 15 girls and 12 boys, writing girls to boys as 15:12 with whole numbers and a colon [3].

STUDENTS DO

1. Chant the three steps and write 15:12 and 12:15 on whiteboards, labelling which is which.
2. With a partner, say what 3:2 means for blue and red dots and what 2:3 would mean instead.

Say: A ratio is a way of comparing similar quantities by writing numbers separated by colons [3]. It uses whole numbers only, with no units, in the correct order [3]. Ratios are usually written in the form a:b [9].

Worked example: 15 girls and 12 boys, girls to boys. Step 1: first quantity is 15, write 15. Step 2: write colon 15:. Step 3: second quantity is 12, write 15:12. Check no units and girls first, because order matters [4].

Ask: Where does the number of girls go in girls to boys? (First, 15:12, because it is important to write ratios in the correct order [4].) · Why do we leave out cm, p or ml in the ratio? (A ratio is normally written using whole numbers only, with no units [3].)

Check understanding: All hold up 15:12 for girls to boys. If many write 12:15, re-model first-named first-written with dots.

Support: Give sentence starter ___ to ___ is ___ : ___ and dot pictures to count. **Stretch:** Ask pupils to write boys to total and girls to total as part-to-whole ratios.

Use: Slides 3-6, Video clip 1 (0:00-3:14)

20–32 min **Teaching: simplest form** 12 min · Whole class

Model dividing both sides by the same number to reach simplest form.

YOU DO

1. Talk through Slide 7 bullets: divide both sides by the same number until nothing else divides both.
2. Show shortcut of dividing by the highest common factor and checking by scaling back up.
3. Play Video clip 4 on Slide 8 and pause when 12:18 becomes 6:9 then 2:3 [5].
4. Model 40:28 by dividing by 2 to 20:14 then to 10:7, or by the highest common factor 4 straight to 10:7 [9].

STUDENTS DO

1. Copy the two-step division for 12:18 and the one-step highest common factor route for 40:28.
2. On whiteboards, circle the divisor used and show the check by multiplying back up.

Say: Both sides of the ratio can be divided by the same number to give an equivalent ratio in the simplest form [9]. Keep going until no number divides into both exactly. Then scale back up to check you kept the same comparison.

Worked example: Simplify 12:18. Both divide by 2 to give 6:9 [5]. Both divide by 3 to give 2:3 [5]. Nothing else divides 2 and 3, so 2:3 is simplest form. Check: 2:3 scaled by 6 gives 12:18.

Ask: Why do we divide both 12 and 18 by the same number? (To keep the relationship the same and make an equivalent ratio [9].) · What is the highest common factor of 40 and 28 and what does it give? (4, which gives 10:7 straight away [9].)

Check understanding: Hinge question on whiteboards: simplest form of 12:18? Expect 2:3. Re-teach common factors if many show 6:9 only.

Support: Provide a list of divisors to try and show 8:12 can be simplified to 2:3 by dividing by 4 [6]. **Stretch:** Give 250:150 and ask for two steps 25:15 then 5:3 and the one-step highest common factor [3].

Use: Slides 7-8, Video clip 4 (0:00-5:00)

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32–50 min **Main: Pence to Pounds Puzzle** 18 min · Pairs

Practise converting to the same units then writing and simplifying money ratios.

YOU DO

1. Set the task on Slide 9: write each pair as a:b in correct order, no units, use same units first, simplify with highest common factor.
2. Model the puzzle: lay out 15p next to £3, convert £3 to 300p, write 15:300 which simplifies to 1:20 [3].
3. Hand out Worksheet Tasks B-C and replica money, reminding pupils the same units must be used or the comparison will be wrong [3].
4. Circulate, prompting for conversion step in pence before dividing, and collect two good solutions to share.

STUDENTS DO

1. In pairs, lay out replica money, use the £1 = 100p strip to convert, then write ratios on whiteboards.
2. Complete Worksheet Tasks B-C, showing conversion, original ratio and simplest form, then swap to check.

Say: Lay out the coins, change pounds to pence first, then write the ratio with a colon and no units [3]. Divide both sides by the same number until simplest form [9]. In pairs, write the conversion, the first ratio and the simplified ratio.

Worked example: 15p to £3. Step 1: change £3 to 300p. Step 2: write 15:300 with whole numbers, no units [3]. Step 3: highest common factor is 15, divide both to get 1:20. Check: 1:20 scaled by 15 gives 15:300.

Ask: What do you do before writing 20p to £2? (Change £2 to 200p, then write 20:200 and simplify to 1:10.) · How do you know 1:20 is simplest? (No number divides into both 1 and 20 except 1, and scaling back gives 15:300.)

Check understanding: Pairs hold up conversion plus both ratios. If conversion missing, pause and re-model one pounds-to-pence change together.

Support: Give a pre-filled pounds-to-pence line and remind them the same units must be used or the comparison will be wrong [3]. **Stretch:** Challenge pupils to compare two amounts where both need converting and the simplest form still needs dividing twice.

Use: Slide 9, Worksheet Tasks B-C

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50–60 min **Plenary and exit** 10 min · Whole class

Fix key ideas and check every pupil can simplify to simplest form.

YOU DO

1. Use Slide 10 bracelet: 5 yellow and 15 blue beads, ratio 5:15 simplifies to 1:3, and ask pupils to prove the factor.
2. Run Slide 11 vote on trickiest part: order, highest common factor, same units first, knowing when finished.
3. Give Slide 12 exit ticket: write 40:28 in simplest form plus one thing learnt and one question.
4. Collect exit tickets and recap: same units, correct order, divide both sides to simplest form.

STUDENTS DO

1. Vote, explain choices to a partner, and correct the bracelet ratio together.
2. Complete the exit ticket on paper in silence and hand it in.

Say: Remember 50:70 means 5 boys for every 7 girls after simplifying [9]. Both 100:400 and 200:800 mean the same as 1:4 because both sides were multiplied by the same number [9]. Now show it on your own.

Ask: Why is 5:15 the same as 1:3? (Both sides divided by 5, an equivalent ratio in simplest form [9].) · What trips you up most and what will you do next time? (For example, forgetting same units, so change pounds to pence first [3].)

Check understanding: Read exit tickets for 10:7. If many miss highest common factor, start next lesson with 40:28 re-teach.

Support: Allow the £1 = 100p strip and highest common factor list for the exit ticket. **Stretch:** Ask for a second proof: show 10:7 scaled by 4 gives 40:28.

Use: Slides 10-12

Common mistakes

Mistake	How to spot it	How to fix it
Writing 15p to £3 as 15:3 without converting units	Ratio has very different sizes but no 100 or 300 in working	Change to same units first, £3 to 300p, then 15:300 simplifies to 1:20 [3].
Swapping the order, writing 4:1 for orange to water 1:4	First and second numbers reversed compared with words	Underline first-named quantity and write it first, because changing order changes proportions [4].
Dividing only one side, for example 12:18 to 6:18	One side unchanged and scaling back does not match start	Divide both sides by the same number to keep an equivalent ratio, then check by scaling up [9].

Support

- Use dot pictures, coin strips and sentence starters for ___ to ___ is ___ : ___
- Provide divisor lists and highest common factor hints, with pre-filled pounds-to-pence lines

Stretch

- Design a stronger squash mix with same total volume and explain the ratio change
- Create a tricky money ratio that needs two conversions and two divides, then swap to solve

For the LSE or teaching assistant

Sit with target pairs in main task. Prompt conversion to pence first, then counting, then dividing both sides. Check order by asking which word came first.

Check for understanding

Question	Answer
Write 40:28 in simplest form.	10:7
Write 15p to £3 in simplest form.	1:20
Write girls to boys for 15 girls and 12 boys in simplest form.	5:4

Homework

Write two money comparisons from home as ratios in simplest form, showing the pence conversion.

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