

Name _____

Date _____

Unit 4 · Decimals — teaching slides

30 slides, formatted for printing.

4.1 Ordering decimals

Different whole-number parts

- Start by ignoring everything after the point.
- Compare the whole-number parts.
- If they are different, you already have your answer.

8.9, 14.639, 6.45

Whole-number parts: 8, 14, 6

In order: 6.45, 8.9, 14.639

Same whole-number parts

- Now compare the **tenths**.
- If the tenths are equal too, compare the **hundredths**.
- Keep going, one place at a time, from the left.

2.82, 2.6, 2.816 – all have 2 units

Tenths: 8, 6, 8 – so 2.6 is smallest

Hundredths of the other two: 2 and 1

In order: 2.6, 2.816, 2.82

More digits does not mean bigger

- This is the misconception to break.
- 2.816 has more digits than 2.82 but is smaller.
- Place value decides, never digit count.

$2.816 < 2.82$ ✓

$0.45 < 0.5$ ✓

$0.089 < 0.09$ ✓

Fill with zeros to line up

- Give every number the same number of decimal places.
- Adding zeros on the end changes nothing.
- Now the columns line up and comparison is obvious.

4.6, 4.66, 4.08
 → 4.60, 4.66, 4.08
 In order: 4.08, 4.60, 4.66

Zeros on the end

- 0.5, 0.50 and 0.500 are all the same number.
- Zeros **after** the last non-zero decimal add nothing.
- But a zero **between** digits matters: 0.05 is not 0.5.

$0.5 = 0.50 = 0.500$ ✓ same
 $0.05 \neq 0.5$ × ten times smaller

Compare like with like

- Measurements must be in the same unit before you compare.
- Convert first, then order.

0.5 kg, 450 g, 0.45 kg
 450 g = 0.45 kg
 In order: 0.45 kg, 0.45 kg, 0.5 kg

4.2 Adding and subtracting decimals

Line up the points

- In a written method the decimal points go in a vertical line.
- That puts units under units, tenths under tenths, and so on.
- Fill any empty places with zeros.

10.00
 – 4.83
 ———
 5.17

Mental method: partition

- Split each number into its whole-number part and its decimal part.
- Add the whole numbers, add the decimals, then put them together.
- This is the method most learners find easiest.

$2.3 + 7.8$
 $= (2 + 7) + (0.3 + 0.8)$
 $= 9 + 1.1$
 $= 10.1$

Mental method: round and adjust

- If a number is close to a whole number, round it.
- Do the easy calculation.
- Then adjust by the amount you rounded.

$$\begin{aligned}6.9 + 12.4 \\&= 7 + 12.4 = 19.4 \text{ (added } 0.1 \text{ too much)} \\&= 19.4 - 0.1 = 19.3\end{aligned}$$

Adjusting a subtraction

- Rounding the number you are subtracting works the same way,
- but the adjustment goes the other way.
- Take away too much, then give it back.

$$\begin{aligned}13.3 - 5.8 \\&= 13.3 - 6 = 7.3 \text{ (took } 0.2 \text{ too much)} \\&= 7.3 + 0.2 = 7.5\end{aligned}$$

Watch the carrying

- Ten tenths make one unit.
- So decimal parts can add up to more than 1.
- $0.3 + 0.8$ is 1.1, not 0.11.

$$\begin{aligned}0.3 + 0.8 &= 1.1 \checkmark \\0.3 + 0.8 &= 0.11 \times \\0.9 + 0.9 &= 1.8\end{aligned}$$

Estimate first

- Round each number to the nearest whole number in your head.
- That tells you roughly what the answer should be.
- If your exact answer is far away, you have made a slip.

$$\begin{aligned}2.3 + 7.8 &\approx 2 + 8 = 10, \text{ and the answer is } 10.1 \checkmark \\20 - 12.83 &\approx 20 - 13 = 7, \text{ and the answer is } 7.17 \checkmark\end{aligned}$$

4.3 Multiplying decimals

The three-step method

- Multiply as if there were no decimal point at all.
- Count the decimal places in the question.
- Put that many decimal places in the answer.
- That is the whole method — nothing else changes.

0.002×4
 $2 \times 4 = 8$
 3 decimal places in the question
 So the answer is 0.008

Counting the places

- Count the digits after the point in **both** numbers.
- Add them together.
- That total is how many the answer needs.

$30 \times 0.06 \rightarrow 0 + 2 = 2 \text{ places}$
 $30 \times 6 = 180 \rightarrow 1.80$
 $4.76 \times 3.7 \rightarrow 2 + 1 = 3 \text{ places}$

Zeros at the end

- 1.80 and 1.8 are the same number.
- You may drop a zero at the end of the answer.
- Never drop a zero in the middle — 1.08 is not 1.8.

$1.80 = 1.8$ ✓ tidy it up
 0.008 stays 0.008 — the zeros are not at the end

A long multiplication

- The same method works for big numbers.
- Use whatever written method you prefer for the whole numbers.
- Only the final step is about the decimal point.

476×3.7
 $476 \times 37 = 17\ 612$
 1 decimal place in the question
 So the answer is 1761.2

Multiplying can make things smaller

- Multiplying by a number less than 1 gives a smaller answer.
- This surprises learners who expect multiplying to grow things.
- Half of 8 is 4 — and half is 0.5.

$0.4 \times 0.7 = 0.28$ (smaller than both)
 $0.5 \times 8 = 4$
 $0.25 \times 8 = 2$

Estimate to place the point

- Round each number to something easy.
- That tells you roughly how big the answer is.
- It is the quickest way to catch a misplaced decimal point.

$$476 \times 3.7 \approx 500 \times 4 = 2000$$

So 1761.2 is sensible; 176.12 would not be

$$2.4 \times 15 \approx 2 \times 15 = 30, \text{ and } 36 \text{ is close } \checkmark$$

4.4 Dividing decimals

Keep the point in line

- Write the division out in the usual bus-stop layout.
- Put the decimal point in the answer directly above the one below.
- Then divide digit by digit as normal.

$$2 \text{ . } 1$$

$$4 \text{) } 8 \text{ . } 4$$

$$8.4 \div 4 = 2.1$$

When it does not divide exactly

- Add zeros after the decimal point — they change nothing.
- Carry the remainder on into the next column.
- Keep going until the remainder is zero.

$$7 \div 4$$

$$7 = 7.00$$

$$7.00 \div 4 = 1.75$$

When it never ends

- Some divisions repeat for ever.
- You cannot write them exactly as a decimal.
- The question will tell you the degree of accuracy to use.

$$2 \div 3 = 0.666666...$$

To 3 decimal places: 0.667

$$100 \div 7 = 14.2857... \rightarrow 14.29 \text{ (2 d.p.)}$$

Zara's method for rounding

- Work the division out to **one more** decimal place than you need.
- Then round that answer.
- That extra digit is exactly what tells you which way to round.

Work out $8.46 \div 7$ to 2 d.p.

Divide to 3 d.p.: 1.208...

The third digit is 8, so round up: 1.21

Checking with multiplication

- Division and multiplication are inverse operations.
- Multiply your answer back and you should get the original number.
- This catches misplaced decimal points instantly.

$$8.4 \div 4 = 2.1$$

$$\text{Check: } 2.1 \times 4 = 8.4 \checkmark$$

$$9 \div 8 = 1.125, \text{ and } 1.125 \times 8 = 9 \checkmark$$

Estimate first

- Round the numbers to something easy.
- That tells you roughly how big the answer should be.
- A misplaced point is usually out by a factor of 10.

$$23.4 \div 9 \approx 24 \div 8 = 3, \text{ and the answer is } 2.6 \checkmark$$

$$16.8 \div 8 \approx 16 \div 8 = 2, \text{ and the answer is } 2.1 \checkmark$$

4.5 Making decimal calculations easier

Rewrite the decimal as a fraction

- Every decimal is a fraction in disguise.
- Write it as a division, then reorder the calculation.
- Multiplication and division can be done in any order.

$$0.06 \times 3500$$

$$= 6 \div 100 \times 3500$$

$$= 6 \times (3500 \div 100)$$

$$= 6 \times 35 = 210$$

Learn these by heart

- A handful of decimals come up again and again.
- Knowing them as fractions turns hard multiplications into easy divisions.

$$0.5 = \frac{1}{2} \rightarrow \text{halve it}$$

$$0.25 = \frac{1}{4} \rightarrow \text{divide by 4}$$

$$0.75 = \frac{3}{4} \rightarrow \text{divide by 4, then } \times 3$$

$$0.125 = \frac{1}{8} \rightarrow \text{divide by 8}$$

$$0.1 \rightarrow \text{divide by 10}$$

Partitioning

- Split one number into easier parts.
- Multiply each part separately.
- Then add the results.

$$\begin{aligned}1.5 \times 48 \\&= (1 \times 48) + (0.5 \times 48) \\&= 48 + 24 \\&= 72\end{aligned}$$

Round and compensate

- Round a number to something friendly.
- Do the easy calculation.
- Then adjust by the amount you changed.

$$\begin{aligned}8.2 \times 9 \\&= 8.2 \times (10 - 1) \\&= 82 - 8.2 \\&= 73.8\end{aligned}$$

Double and halve

- Double one number and halve the other.
- The product stays the same, because $\times 2$ and $\div 2$ cancel.
- Repeat until the numbers are easy.

$$\begin{aligned}2.5 \times 16 \\&= 5 \times 8 \\&= 40 \\6.25 \times 16 &= 12.5 \times 8 = 25 \times 4 = 100\end{aligned}$$

Splitting a divisor

- A division by a big number can be split into two easy ones.
- Divide by the factors one at a time.
- Dividing by 10 is always the easiest step, so save it for last.

$$\begin{aligned}12.56 \div 40 \\&= 12.56 \div 4 \div 10 \\&= 3.14 \div 10 \\&= 0.314\end{aligned}$$