

Ages 11–14 · Maths

LESSON SLIDES

Percentages

Maths · Fractions, decimals, percentage change and reverse percentages

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Percentages

SPEAKER NOTES

Show a sale sign such as "Up to 40% off" and ask: if a EUR 50 top is 40% off, is it now EUR 10? Collect answers without correcting them yet. Tell students that by the end of the lesson they will be able to check any sale price, pay rise or test score in one step.

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By the end of this lesson you can

- 🎯 Convert between fractions, decimals and percentages
- 🎯 Find a percentage of an amount
- 🎯 Increase and decrease by a percentage with a multiplier
- 🎯 Work out a percentage change
- 🎯 Find the original value: reverse percentages

By the end of this lesson you can

SPEAKER NOTES

Read the objectives aloud. Tell students there is a five-question quiz at the end, and that the multiplier idea on slide 9 is the one tool that ties everything together.

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What is a percentage?

- Per cent means out of a hundred
- $37\% = 37/100 = 0.37$
- 100% is the whole amount
- Percentages can be more than 100%: 150% of 40 = 60
- Percentages make different totals easy to compare

What is a percentage?

SPEAKER NOTES

Shade 37 squares of a 10 by 10 grid to show 37%. Ask: what would 100% look like, and what would 150% look like? Some students believe a percentage can never go above 100; a price that rises by half to 150% of its old value is a good counter-example.

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Fractions, decimals and percentages

- Percentage to decimal: divide by 100, so $45\% = 0.45$
- Decimal to percentage: multiply by 100, so $0.06 = 6\%$
- Fraction to percentage: $3/8 = 3 \div 8 = 0.375 = 37.5\%$
- Percentage to fraction: $45\% = 45/100 = 9/20$

Fractions, decimals and percentages

SPEAKER NOTES

Work through each conversion on the board. A very common error is writing 0.06 as 60%; ask students to say the decimal as 6 hundredths before converting. Ask: which is bigger, $3/8$ or 40%? Converting both to percentages gives 37.5% and 40%, so 40% is bigger.

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Equivalents worth knowing

Fraction

- $\frac{1}{2}$
- $\frac{1}{4}$ and $\frac{3}{4}$
- $\frac{1}{5}$
- $\frac{1}{10}$
- $\frac{1}{3}$

Percentage

- 50%
- 25% and 75%
- 20%
- 10%
- about 33.3% (it recurs)

Equivalents worth knowing

SPEAKER NOTES

Cover one column and ask students to call out the other. Point out that $\frac{1}{3}$ is 33.333...% and never ends, so we round it. Ask: what is $\frac{2}{5}$ as a percentage? Two lots of 20% gives 40%.

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 Example

Percentage of an amount: no calculator

- 1 Find 35% of 240
- 2 $10\% = 240 \div 10 = 24$
- 3 $30\% = 3 \times 24 = 72$
- 4 $5\% = \text{half of } 10\% = 12$
- 5 $35\% = 72 + 12 = 84$

Percentage of an amount: no calculator

SPEAKER NOTES

Model the building-block method step by step. Ask a student to find 12% of 240 the same way: 10% is 24, 1% is 2.4, so 12% is $24 + 2.4 + 2.4 = 28.8$. Watch for students who find 10% by dividing by 100 instead of 10.

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 Example

Percentage of an amount: use a decimal

- 1 Change the percentage to a decimal, then multiply
- 2 $35\% \text{ of } 240 = 0.35 \times 240 = 84$
- 3 $17.5\% \text{ of } 80 \text{ kg} = 0.175 \times 80 = 14 \text{ kg}$
- 4 Check: is the answer a sensible size?

Percentage of an amount: use a decimal

SPEAKER NOTES

Show that both methods give 84. Ask: should 17.5% of 80 kg be more or less than 20 kg? Less, because 25% would be 20 kg. Estimating first catches typing errors on the calculator.

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 Example

One amount as a percentage of another

- 1 Write a fraction, then multiply by 100
- 2 18 out of 24 = $18 \div 24 \times 100 = 75\%$
- 3 Use the same units first
- 4 45 cm out of 2 m = $45 \div 200 \times 100 = 22.5\%$

One amount as a percentage of another

SPEAKER NOTES

A test score is the most familiar example: 18 marks out of 24 is 75%. Ask: what goes wrong if we work out $45 \div 2 \times 100$? We get 2,250%, which cannot be right for a part of a length. 2 m must become 200 cm before dividing.

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Increase vs decrease: the multiplier

Increase by 15%

- Keep 100%, add 15%: 115%
- Multiplier = 1.15
- $\text{GBP } 60 \times 1.15 = \text{GBP } 69$

Decrease by 25%

- Keep 100%, take off 25%: 75%
- Multiplier = 0.75
- $\text{EUR } 80 \times 0.75 = \text{EUR } 60$

Increase vs decrease: the multiplier

SPEAKER NOTES

Show the two-step method once ($60 + 9 = 69$ and $80 - 20 = 60$), then show that the multiplier does it in one step. Ask: what multiplier increases by 3%? 1.03. What multiplier decreases by 8%? 0.92. A common mistake is 0.08 for an 8% decrease.

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 Example

Working out a percentage change

- 1 Percentage change = $\text{change} \div \text{original} \times 100$
- 2 USD 50 rises to USD 62: change = 12
- 3 $12 \div 50 \times 100 = 24\%$ increase
- 4 2.5 kg falls to 2 kg: $0.5 \div 2.5 \times 100 = 20\%$ decrease

Working out a percentage change

SPEAKER NOTES

Stress the word original. Ask: what happens if we divide 12 by 62 instead? We get about 19.4%, which is wrong because the change is measured from where we started. Check the answer with a multiplier: $50 \times 1.24 = 62$.

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 Example

Reverse percentages: find the original

- 1 After 20% off, a phone costs GBP 360
- 2 Sale price = 80% of the original
- 3 $\text{Original} \times 0.8 = 360$
- 4 $\text{Original} = 360 \div 0.8 = \text{GBP } 450$
- 5 Check: $450 \times 0.8 = 360$

Reverse percentages: find the original

SPEAKER NOTES

Draw a bar split into ten equal parts: eight parts are worth GBP 360, so one part is GBP 45 and ten parts are GBP 450. Ask: a price including a 20% sales tax is EUR 96. What was it before tax? $96 \div 1.2 = \text{EUR } 80$.

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Three common traps

- Reverse: $360 \times 1.2 = 432$ is wrong; divide by 0.8
- Up 10% then down 10%: $100 \times 1.1 \times 0.9 = 99$
- Dividing by the new value instead of the original
- 40% to 50% is 10 percentage points, but a 25% rise

Three common traps

SPEAKER NOTES

Take each trap in turn and ask students to explain why it fails. The last one appears in news reports: a rise from 40% to 50% is 10 percentage points, but as a percentage change it is $10 \div 40 \times 100 = 25\%$. This line is an extension for older students.

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One number does the whole job

× 1.15 the multiplier for any 15% increase

- Increase: multiplier above 1
- Decrease: multiplier below 1
- Reverse: divide by the multiplier

One number does the whole job

SPEAKER NOTES

Summarise the multiplier idea before the quick check. Ask students to give the multiplier for a 7% increase (1.07), a 30% decrease (0.7) and a 100% increase (2). Doubling is a 100% increase, which surprises many students.

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 Quick check

A concert ticket costs EUR 40. The price goes up by 15%. What is the new price?

A EUR 46

B EUR 55

C EUR 6

D EUR 34

Quick check

SPEAKER NOTES

Answer: A, EUR 46, because $40 \times 1.15 = 46$. EUR 55 comes from adding 15 to 40, EUR 6 is only the increase, and EUR 34 is a 15% decrease. Ask students who chose each wrong answer to spot their own mistake.

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Key takeaways

- ✓ Per cent means out of 100: $37\% = 0.37 = 37/100$
- ✓ Percentage of an amount: decimal $\times$ amount
- ✓ Increase or decrease: multiply by $1 \pm$ the decimal
- ✓ Percentage change: $\text{change} \div \text{original} \times 100$
- ✓ Reverse percentages: divide by the multiplier

Key takeaways

SPEAKER NOTES

Recap one example for each bullet aloud. Then move to the five-question quiz on the page and set the worksheet for practice.