

LESSON SLIDES

Percentages

Maths · Fractions, decimals, percentage change and reverse percentages

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

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

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: $45\% = 45/100 = 9/20$

Equivalents worth knowing

Fraction

- $1/2$
- $1/4$ and $3/4$
- $1/5$
- $1/10$
- $1/3$

Percentage

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

 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 $35\% = 72 + 12 = 84$

 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?

 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 = $45 \div 200 \times 100 = 22.5\%$

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
- $\text{EUR } 80 \times 0.75 = \text{EUR } 60$

 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

 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: $450 \times 0.8 = 360$

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

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

 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

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