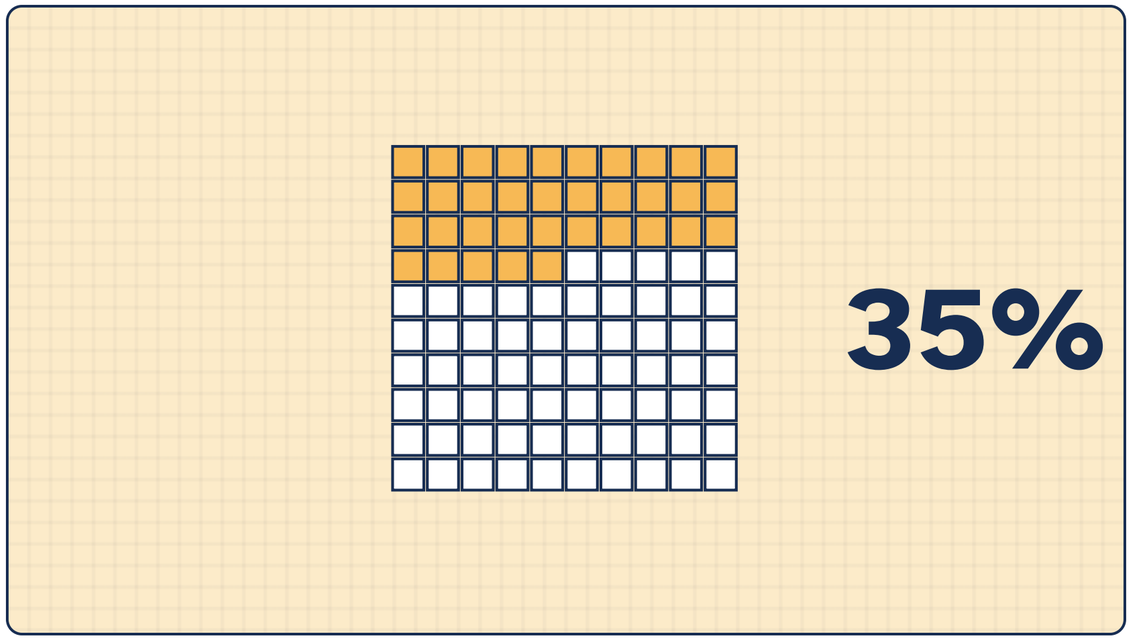
Maths · Fractions, decimals, percentage change and reverse percentages

Percentages



Goals

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 ÷ 8 = 0.375 = 37.5%
- Percentage to fraction: 45% = 45/100 = 9/20

Equivalents worth knowing

Fraction	Percentage
1/2	50%
1/4 and 3/4	25% and 75%
1/5	20%
1/10	10%
1/3	about 33.3% (it recurs)

Worked example

Percentage of an amount: no calculator

- Find 35% of 240
- 10% = 240 ÷ 10 = 24
- 30% = 3 × 24 = 72
- 5% = half of 10% = 12
- 35% = 72 + 12 = 84

Worked example

Percentage of an amount: use a decimal

- Change the percentage to a decimal, then multiply
- 35% of 240 = 0.35 × 240 = 84
- 17.5% of 80 kg = 0.175 × 80 = 14 kg
- Check: is the answer a sensible size?

Worked example

One amount as a percentage of another

- Write a fraction, then multiply by 100
- 18 out of 24 = 18 ÷ 24 × 100 = 75%
- Use the same units first
- 45 cm out of 2 m = 45 ÷ 200 × 100 = 22.5%

Increase vs decrease: the multiplier

Increase by 15%

- Keep 100%, add 15%: 115%
- Multiplier = 1.15
- GBP 60 × 1.15 = GBP 69

Decrease by 25%

- Keep 100%, take off 25%: 75%
- Multiplier = 0.75
- EUR 80 × 0.75 = EUR 60

Worked example

Working out a percentage change

- Percentage change = change ÷ original × 100
- USD 50 rises to USD 62: change = 12
- 12 ÷ 50 × 100 = 24% increase
- 2.5 kg falls to 2 kg: 0.5 ÷ 2.5 × 100 = 20% decrease

Worked example

Reverse percentages: find the original

- After 20% off, a phone costs GBP 360
- Sale price = 80% of the original
- Original × 0.8 = 360
- Original = 360 ÷ 0.8 = GBP 450
- Check: 450 × 0.8 = 360

Three common traps

- Reverse: 360 × 1.2 = 432 is wrong; divide by 0.8
- Up 10% then down 10%: 100 × 1.1 × 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

Summary

Key takeaways

1. Per cent means out of 100: 37% = 0.37 = 37/100
2. Percentage of an amount: decimal × amount
3. Increase or decrease: multiply by 1 ± the decimal
4. Percentage change: change ÷ original × 100
5. Reverse percentages: divide by the multiplier