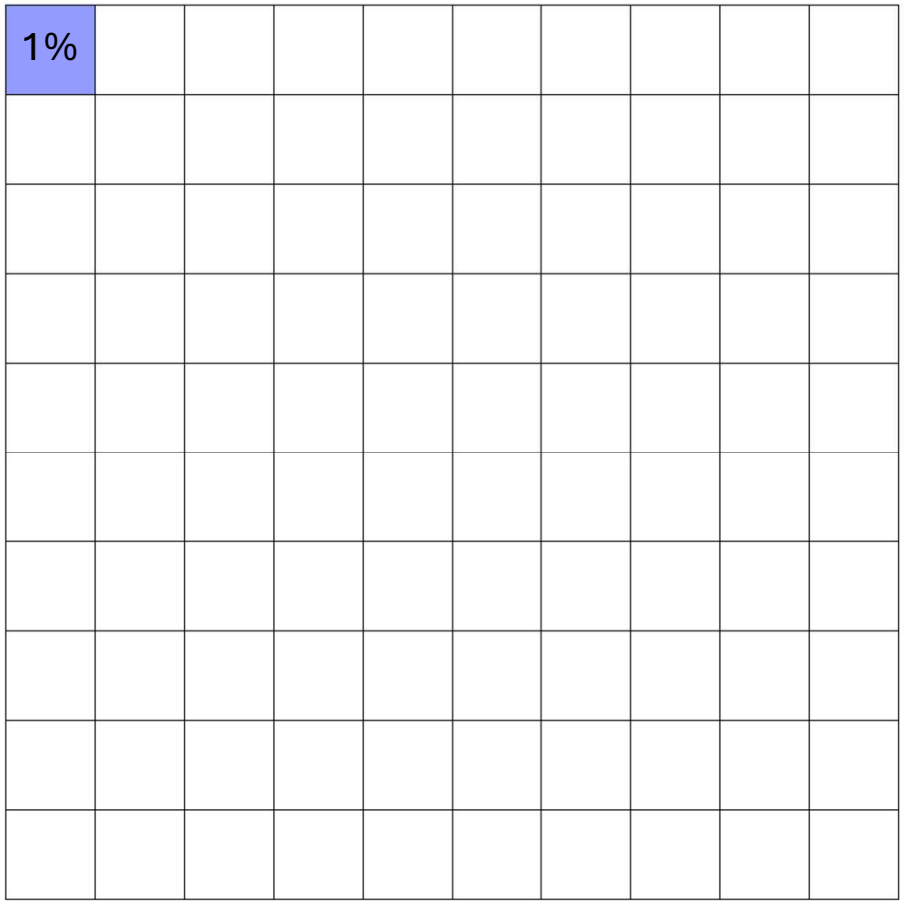
Understanding Percentages

The Language of Percentages

- Percent means “out of 100”.
- Imagine a square divided into 100 equal parts.
- Each part is 1%.
- So, any percentage can be written as a fraction out of 100.
- 50% = 50 out of 100 = $\frac{50}{100}$
- 25% = 25 out of 100 = $\frac{25}{100}$
- 10% = 10 out of 100 = $\frac{10}{100}$

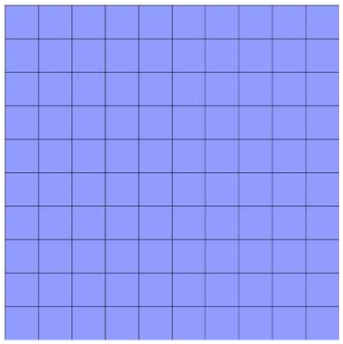


Percentages in Different Forms

Percent means out of 100. Percentages can be written as fractions or decimals, and many common ones convert into familiar fractions that make maths quicker and easier without a calculator.

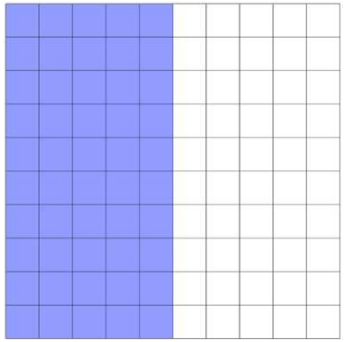
Percentage	Fraction	Decimal
100%	$\frac{100}{100} = \frac{1}{1}$	1
50%	$\frac{50}{100} = \frac{1}{2}$	0.5
25%	$\frac{25}{100} = \frac{1}{4}$	0.25
20%	$\frac{20}{100} = \frac{1}{5}$	0.2
10%	$\frac{10}{100} = \frac{1}{10}$	0.1
1%	$\frac{1}{100}$	0.01

Percentages in Different Forms



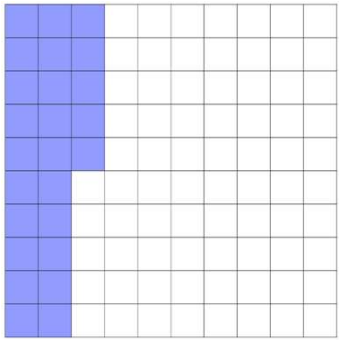
$$100\% = \frac{100}{100} = \frac{1}{1}$$

÷ 100 ÷ 100



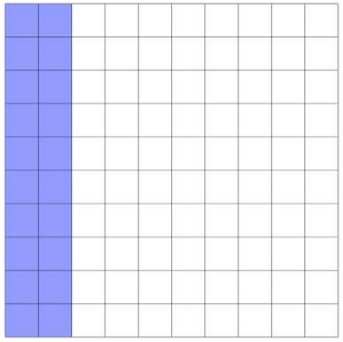
$$50\% = \frac{50}{100} = \frac{1}{2}$$

÷ 50 ÷ 50



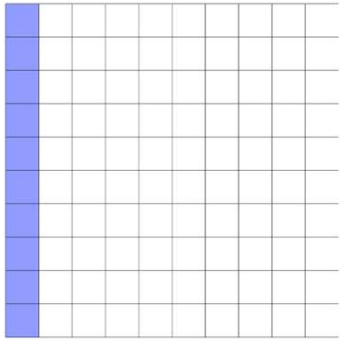
$$25\% = \frac{25}{100} = \frac{1}{4}$$

÷ 25 ÷ 25



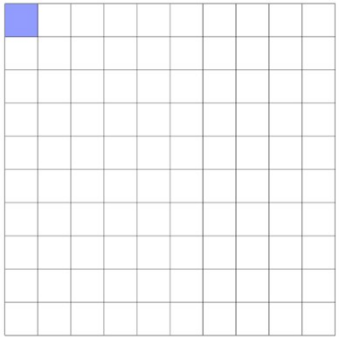
$$20\% = \frac{20}{100} = \frac{1}{4}$$

÷ 20 ÷ 20



$$10\% = \frac{10}{100} = \frac{1}{10}$$

÷ 10 ÷ 10



$$1\% = \frac{1}{100}$$

Writing One Number as a Percentage of Another (Non-Calculator)

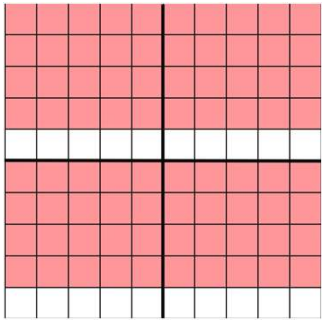
It can be useful to describe one number as a percentage of another, for example a test score. When the numbers are friendly, this can be done without a calculator.

Method:

- **Write** the number as a fraction.
- **Check:** Is the denominator friendly?(Can it be easily scaled to 100?)
- If yes, **scale** the fraction so the denominator is 100.
- **Write** the result as a percentage.
- **State** the final answer.

Example: You score 20/25 on a maths test. What percentage did you get?

$$\frac{20}{25} \overset{\times 4}{=} \frac{80}{100} = 80\%$$



Answer: I scored 80% on my maths test.

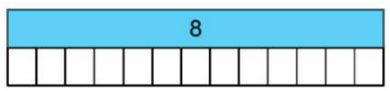
Writing One Number as a Percentage of Another (Calculator)

It can be useful to describe one number as a percentage of another, for example a test score. When the numbers are not friendly, using a calculator is the quickest method.

Method:

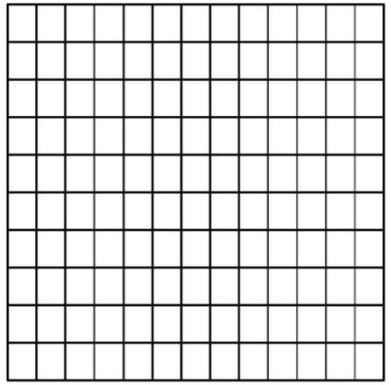
- **Write** the numbers as a fraction.
- **Check:** Is the denominator friendly?(Can it be easily scaled to 100?) For example, 10, 25, 50, 200 and 500.
- If not, **use a calculator** to change the fraction to a decimal.
- **Multiply** the decimal by 100 to find the percentage.
- **State** the final answer clearly.

Example: You score 8/13 on a maths test. What percentage did you get?



1 part = $0.\dot{6}$

$\frac{8}{13}$ x 100 = 62%



100 parts = 62

Answer: I scored 62% on my maths test.

Finding Percentage of an Amount (Non-Calculator - Equivalent Fractions)

Finding a percentage of an amount is easier when the percentage has a single, friendly equivalent fraction.

Method:

- **Identify** the percentage you need to find.
- **Check:** Can it be written as a friendly fraction?
- **Draw** a bar model to represent the problem.
- **Find** the value of the part.
- **State** the final answer clearly.

Example: Find 25% of £160

$$25\% = \frac{25}{100} = \frac{1}{4}$$

160			
25%	25%	25%	25%
1/4	1/4	1/4	1/4

$160 \div 4 = 40$

Answer: £40

Finding Percentage of an Amount (Non-Calculator - Stacking Friendly Percentages)

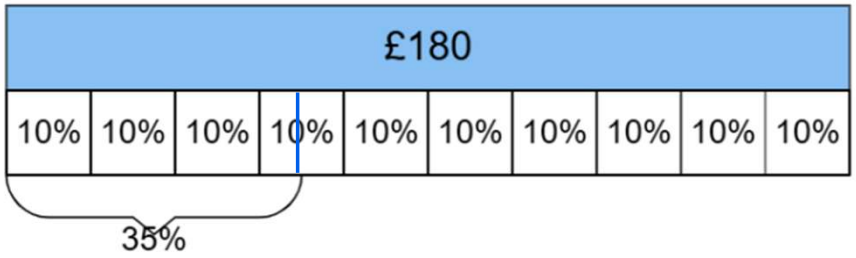
Finding a percentage of an amount is harder when there is no single equivalent fraction. In this case, the percentage can often be broken into friendly percentages that are easier to work with.

Method:

- **Identify** the percentage you need to find.
- **Check:** Is there a friendly fraction? If not, break the percentage into friendly percentages (ones with known fractions or easy methods).
- **Draw** a bar model to represent the whole amount.
- **Divide** the bar using the friendly percentages.
- **Find** the easiest percentages first.
- **Use known parts** to find other parts.
- **Repeat** until all parts are found.
- **Add** the parts together and state the final answer.

Example: Find 35% of £180

- 35% does **not** equal $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$ etc…
- 35% = 10% + 10% + 10% + 5%



10% of 180 = 180 ÷10 = 18
30% of 180 = 18 x 3 = 54
5% of 180 = 18 ÷ 2 = 9
35% of 180 = 54 + 9 = 63

Answer: 35% of £180 is £63

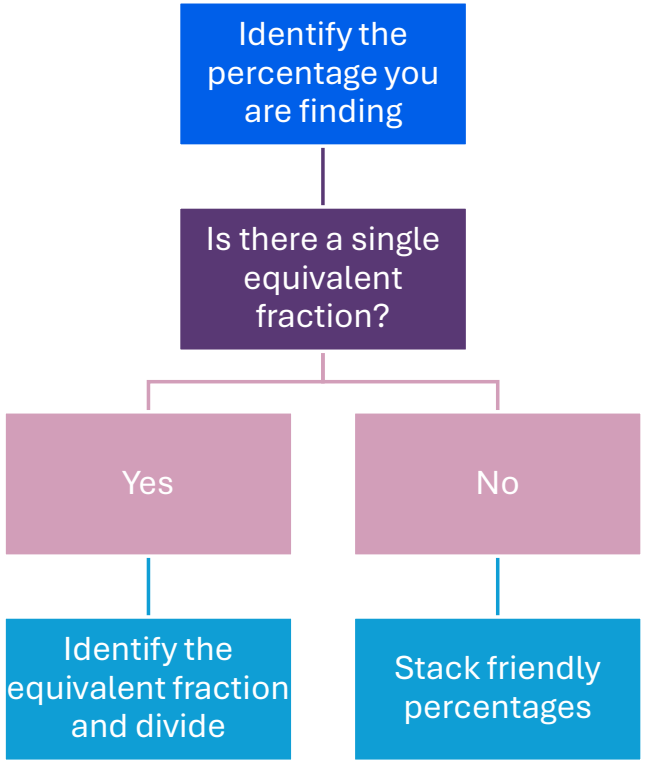
Finding a Percentage of an Amount: Decision Tree

There are two non-calculator methods for finding a percentage of an amount. The method you choose depends on the percentage you are finding: whether it has one friendly equivalent fraction, or whether it needs to be broken into friendly percentages that can be stacked.

Example: A new bike costs 100. You pay a 50% deposit. How much do you pay?

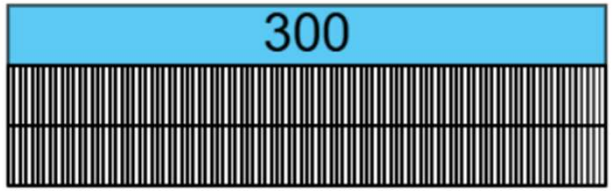
50% is equivalent to $\frac{1}{2}$

100	
50%	50%
1/2	1/2



Example: 300 people enter a competition to win tickets to a concert. 3% get tickets. How many people win tickets?

There is no fraction equivalent to 3%. However, 3% = 1% + 1 % + 1 % and 1% is equivalent to $\frac{1}{100}$



Each small bar is 1% or $\frac{1}{100}$

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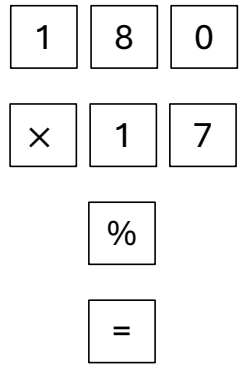
Finding Percentage of an Amount (Calculator)

Equivalent fractions and friendly percentages are useful without a calculator, but you should also know the calculator method.

Method:

- **Type** in the amount on your calculator.
- **Multiply** by the percentage.
- Press the **%** key.
- Press the **equal** sign.
- **Read** the answer.
- **State** the final answer.

Example: Find 17% of £180



How this works

The % key tells the calculator to treat the number 17 as a fraction out of 100. It divides 17 by 100, which converts it into its decimal equivalent, 0.17.

Answer: Find 17% of £180

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Percentage Increase

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Percenatge Decrease

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Repeated Percentage Change

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Reverse Percentages

Acknowledgements

- Images were created using free virtual manipulatives available at Mathsbot.com

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