



Percentages



**Year 11 General Maths
Units 1 and 2**

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Learning Objectives

By the end of the lesson I would hope that you have an understanding and be able to apply to questions the following concepts:

- Understand how to convert between fractions and decimals to percentages
- Understand how to convert from a percentage into a decimal or a fraction
- Know how to find a percentage of a quantity
- How to use percentages to compare two quantities

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Recap

In the previous lessons we have looked at:

- Order of operation (BIDMAS), and
- Directed Numbers
- Powers and roots
- Approximations, decimal places and significant figures
- Conversion of units

This part of the course is recapping all the foundations you are going to be using for the rest of the course. It's really important that you practice the skills being taught and apply them as much as you can.

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Why use percentages?

We use percentages to help us compare different things.

For example, if I got a score of 45 out of 68 in a test and you got a score of 35 out of 60 in a different test, who did better?

We can't compare them using the scores as the test was out of a different number of marks.

When we use percentages we are **scaling** a score and changing it to be **out of 100**.

$$\frac{45}{68} =$$

$$\frac{35}{60} =$$

$$\frac{\quad}{100} \%$$

↑

$$\frac{\quad}{100} \%$$

↑

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Why use percentages?

Let's use a couple of simple examples:

Write the following as a fraction out of 100:

$$\frac{10}{20}$$

$$\frac{30}{50}$$

$$\frac{10}{20} \xrightarrow{\times 5} \frac{50}{100} = 50\%$$

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

$$\frac{30}{50} \xrightarrow{\times 2} \frac{60}{100} = 60\%$$

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Why use percentages?

We are really using ratios and just changing the ratio to be out of 100.

$$\frac{10}{20}$$

$$\frac{30}{50}$$

$$\frac{10}{20} = 0.5$$

50%

50% 100%

$$\frac{30}{50} = 0.6$$

60%

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Converting from a decimal into a percentage

When we divide a fraction we end up with a decimal number.
If we see the previous example, but with the additional step of working:

Example:

Express $\frac{36}{90}$ as a percentage

We can see that to go from the decimal to a percentage we simply multiply by 100.

$$\boxed{0.4} \times \boxed{100} = \underline{\underline{40\%}}$$

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The screenshot shows a TI-84 Plus calculator interface. The top menu bar includes 'Edit', 'Action', and 'Interactive'. The main display area shows the fraction $36/90$ in the top line, which has been rounded to the decimal 0.4 in the second line. Below this, the text 'ans*100' is entered, and the result '40' is displayed in the third line. The bottom of the screen shows the mode selector with 'Alg', 'Decimal', 'Real', and 'Rad' options, with 'Decimal' currently selected.

Examples have been extracted, with permission, from
the Cambridge General Mathematics Units 1 and 2 Textbook

Converting from a decimal into a percentage

Example:

Express 0.75 as a percentage

$$\div \rightarrow \frac{43}{60} = 43 \div 60$$

decimal



x 100



%

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The screenshot shows a calculator interface with the following elements:

- Top bar: "Edit Action Interactive" with a close button.
- Toolbar: Buttons for $\frac{1}{2}$, $\frac{1}{x}$, $\frac{dx}{dx}$, $\frac{dx}{dx}$, $\frac{dx}{dx}$, $\frac{dx}{dx}$, $\frac{dx}{dx}$, $\frac{dx}{dx}$, $\frac{dx}{dx}$, $\frac{dx}{dx}$.
- Input field: "0.75" (boxed in red).
- Calculator display: "ans*100" (boxed in red), "0.75" (boxed in red), and "75" (boxed in red).
- Handwritten notes: "0.75" and "= 75%".
- Bottom bar: "Alg", "Decimal", "Real", "Rad", and a calculator icon.

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the Cambridge General Mathematics Units 1 and 2 Textbook

Converting from a percentage into a fraction

What we do forwards in mathematics, we have to be able to do backwards.

A percentage is nothing more than a number which is divided by 100.

Hence, 23% means $\frac{23}{100}$

And 135% means $\frac{135}{100}$

Where you see the percentage sign, just change the number into a fraction by putting 100 as the denominator of a fraction.

$$23\% = \frac{23}{100}$$

$$135\% = \frac{135}{100}$$

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Converting from a percentage into a fraction

Example:

Express 62% as a common fraction

$$\frac{62}{100}$$




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62/100

0.62

62/100

0.62

Math1	Line		$\sqrt{\square}$	π	\rightarrow
Math2	\square^\square	e^\square	ln	$\log_{\square}\square$	$\sqrt[\square]{\square}$
Math3	$ \square $	x^2	x^{-1}	$\log_{10}(\square)$	solve(
Trig	$\square\square\square$	toDMS	{ \square }	{ }	()
Var	sin	cos	tan	$^\circ$	r
abc					
	\leftarrow			ans	EXE

Converting from a percentage into a fraction

Make sure your calculator is in the correct mode!

Example:

Express 62% as a common fraction

$$= \frac{62}{100} = \frac{31}{50}$$

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The screenshot shows a calculator interface with the following elements:

- Top bar: "Edit Action Interactive" with a close button.
- Toolbar: $0.5 \frac{1}{2}$, $\frac{\square}{\square}$, $\frac{d}{dx}$, $\frac{d}{dx}$, $\frac{d}{dx}$, $\frac{d}{dx}$, $\frac{d}{dx}$, $\frac{d}{dx}$, $\frac{d}{dx}$.
- Display: $\frac{62}{100}$ (boxed in red) and $\frac{31}{50}$ (boxed in red).
- Keypad:
 - Math1: Line, $\frac{\square}{\square}$, $\sqrt{\square}$, π , \rightarrow
 - Math2: \square^{\square} , e^{\square} , \ln , \log_{\square} , $\sqrt[\square]{\square}$
 - Math3: $|\square|$, x^2 , x^{-1} , $\log_{10}(\square)$, $\text{solve}(\square)$
 - Trig: $\square \square \square$, toDMS , $\{\square\}$, $\{\}$, (\square)
 - Var: \sin , \cos , \tan , $^{\circ}$, r
 - abc: \leftarrow , \rightarrow , \rightarrow , ans , EXE
- Bottom bar: Alg, **Standard** (boxed in red), Real, Rad, $\frac{\square}{\square}$.

Converting from a percentage into a fraction

Example:

Express 72% as a decimal

This can be done using a CAS and by hand!

Remember, when we divide by 100 we are moving the decimal point two places to the left.

Sometimes it's quicker to do it by hand than using the CAS.

$$72\% = \frac{72}{100}$$

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The screenshot shows a CAS interface with the following elements:

- Top toolbar: Edit, Action, Interactive, and various mathematical functions like $\frac{1}{2}$, \int , $\frac{d}{dx}$, $\frac{d}{dx}$, $\frac{d}{dx}$, $\frac{d}{dx}$, $\frac{d}{dx}$, $\frac{d}{dx}$.
- Main display area: $\frac{72}{100}$ is entered and highlighted with a red box. To its right, the result 0.72 is displayed and also highlighted with a red box.
- Bottom toolbar: Math1, Math2, Math3, Trig, Var, abc, and navigation buttons.
- Bottom status bar: Alg, **Decimal** (highlighted with a red box), Real, Rad, and a calculator icon.

Finding a percentage of a quantity

The most interesting (and useful!) word in Mathematics is the word **of**.

I like to think of this as a placeholder for the word “times” or “multiply”.

When I see the word “of” I replace it with a times sign.

Example:

Find 15% of \$140

Remember to put the units!

$$\begin{aligned} & 15\% \text{ of } \$140 \\ &= \frac{15}{100} \times 140 \\ &= \underline{\underline{\$21}} \end{aligned}$$

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The screenshot shows a TI-84 Plus calculator in 'Edit Action Interactive' mode. The display shows the calculation $\frac{15}{100} * 140$ and the result 21 . Red boxes highlight the input and the result. The calculator interface includes a toolbar with various mathematical functions and a keypad with rows for Math1, Math2, Math3, Trig, Var, and abc, along with navigation and execution buttons.

Examples have been extracted, with permission, from
the Cambridge General Mathematics Units 1 and 2 Textbook

It's not all about test scores!

We can use percentages to relate lots of things.

For example, the percentage of girls in a classroom or the percentage of mm in a cm.

A percentage is just a ratio. It tells us, using a scale of 100.

Example:

There are 18 girls in a class of 25 students. What percentage of the class are girls?

$$\frac{18}{25} = \frac{72}{100} = \underline{\underline{72\%}}$$

The diagram shows the fraction $\frac{18}{25}$ being multiplied by 4 to get $\frac{72}{100}$. A red arrow above the fraction points from 18 to 72 with the label $\times 4$. A red arrow below the fraction points from 25 to 100 with the label $\times 4$.

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It's not all about test scores!

We can use percentages to relate lots of things.

For example, the percentage of girls in a classroom or the percentage of mm in a cm.

A percentage is just a ratio. It tells us, using a scale of 100.

Example:

Express 76 mm as a percentage of 40 cm.

Don't be tricked! There are different units of measurement which we need to convert first.

$$4 \overline{) 76} \begin{array}{r} 19 \\ \underline{76} \\ 0 \end{array}$$

$$\begin{array}{ccc} \underline{76 \text{ mm}} & & 400 \text{ mm} \\ & \xrightarrow{\div 4} & \\ \frac{76}{400} & = & \frac{19}{100} \\ & \xrightarrow{\div 4} & \\ & & = \underline{19\%} \end{array}$$

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