

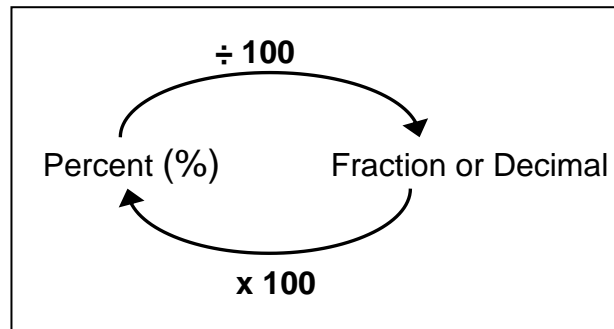
Percentages

What do percentages mean?

Percent (%) means per hundred.

e.g. 22% means 22 per 100, and can also be written as a fraction ($\frac{22}{100}$) or a decimal (0.22)

It is quite straightforward to convert a percent into a fraction or decimal (and vice versa) using the following rules:



Example:

- Write 42% as a fraction and a decimal:

$$42\% = \frac{42}{100} = \frac{21}{50} \quad (\text{simplified})$$

$$42\% = 0.42 \quad (42 \div 100)$$

- Write 0.05 as a percentage:

$$0.05 \times 100 = 5\%$$

Some Common Percentages:

The table shows some commonly used percentages and their equivalent decimal and fraction. It also shows the **easy way** to find these percentages. Try to learn, and remember, these:

Percent	Decimal	Fraction	How to work it out.
10%	0.1	$\frac{1}{10}$	÷10
20%	0.2	$\frac{1}{5}$	÷5
25%	0.25	$\frac{1}{4}$	÷4
50%	0.5	$\frac{1}{2}$	÷2
75%	0.75	$\frac{3}{4}$	÷4 then x3

Examples:

- **Find 25% of 320**

25% is the same as $\frac{1}{4}$ so divide by 4:

$$320 \div 4 = \underline{80}$$

- **Find 50% of 86**

50% is the same as $\frac{1}{2}$ so divide by 2:

$$86 \div 2 = \underline{43}$$

- **Find 75% of 36**

75% is the same as $\frac{3}{4}$ so \div by 4 then \times by 3:

$$36 \div 4 = 9, \quad 9 \times 3 = \underline{27}$$

(See Fractions lesson for more help)

Finding percentages ending in 0 or 5:

Any percentages ending in 0 or 5 can be made up of 10%'s and 5%'s and so there is a quick method of finding them. To find 10% ($\frac{1}{10}$) just divide the number by 10. Once you know 10% you can half it to find 5%.

- **Find 10% of 260**

10% is the same as $\frac{1}{10}$ so divide by 10:

$$260 \div 10 = \underline{26}$$

- **Find 10% of 37**

10% is the same as $\frac{1}{10}$ so divide by 10:

$$37 \div 10 = \underline{3.7}$$

- **Find 40% of 170**

40% is 4 lots of 10% - so find 10% first ($\div 10$):

$$10\% \text{ of } 170 = 17$$

Find 40%:

$$4 \times 17 = \underline{68}$$

- **Find 35% of 80**

35% = 10%+10%+10%+5%

$$10\% \text{ of } 80 = 8$$

(5% is $\frac{1}{2}$ of 10%):

$$5\% \text{ of } 80 = 4$$

$$35\% = 8 + 8 + 8 + 4 = \underline{28}$$

Finding a percentage of a number

If you are asked to find 25%, 50%, 75% or any multiple of 5% you can use the quick method described above. However the following method will work for finding any percent:

$$\boxed{\frac{\textit{percent}}{100} \times \frac{\textit{amount}}{1}}$$

Examples:

- **Find 42% of £350**

$$\frac{42}{100} \times \frac{350}{1} = \text{£}147 \quad (\textit{to do this without a calculator you need to know how to multiply fractions or decimals})$$

(If you prefer multiplying decimals then do 0.42×350)

- **Find 28% of £242**

$$\frac{28}{100} \times \frac{242}{1} = \text{£}67.76$$

(If you prefer multiplying decimals then do 0.28×242)

Percentage Increase or Decrease

Find the percentage as shown above then:

Add it on for an increase
Subtract it for a decrease

Examples:

- **The price of a book increases by 12%. If the original price is £4.70 what is the new price?**

Find 12%: $\frac{12}{100} \times \frac{470}{1} = 56.4p$

Add it on: $\text{£}4.70 + 56p = \text{£}5.26$

So the new price is £5.26

- **The value of a car decreases by 34%. If the original price was £8950 what is it worth now?**

Find 34%: $\frac{34}{100} \times \frac{8950}{1} = \text{£}3043$

Subtract it: $\text{£}8950 - \text{£}3043 = \text{£}5907$

So the new price is £5907

Writing one Number as a Percentage of Another:

To write one number as a percentage of another **make a fraction** (using the two numbers) then **multiply by 100** to turn it into a percent.

$$\frac{\text{Amount}}{\text{How many out of}} \times \frac{100}{1}$$

You can put the 100 over 1 so that you know it is at the **top** of the fraction.

Example:

- Out of a class of 20 children, 17 are going on a school trip. What percentage is this?

$$\frac{17}{20} \times \frac{100}{1} = 85\% \quad (\text{Make 17 out of 20 into a fraction then } \times 100)$$

You could try questions 1-4 at this stage.

Percentage Profit or Loss:

If you are asked what percentage something has increased or decreased by, work out the increase or decrease as a percentage of the **original**.

$$\frac{\text{increase/decrease}}{\text{original}} \times \frac{100}{1}$$

The denominator (bottom) of the fraction is always the **original** amount. Make the fraction then $\times 100$ to make into a percentage.

Example:

- Anna bought a lamp for £45 then sold it a year later for £28. What was her percentage loss (decrease)?

$$\begin{aligned} \text{Loss} &= 45 - 28 = \quad \text{£17} \\ \text{Original price} &= \quad \text{£45} \end{aligned}$$

Using the formula: $\frac{\text{loss (decrease)}}{\text{original}} \times \frac{100}{1}$

$$= \frac{17}{45} \times \frac{100}{1} = \underline{\underline{37.8\%}} \text{ (loss)}$$

- A business starts the financial year with £6000 in the bank and ends with £14,300. What is the percentage profit?

$$\begin{aligned} \text{Profit} &= 14,300 - 6000 = \quad \text{£8300} \\ \text{Original amount} &= \quad \text{£6000} \end{aligned}$$

$$\frac{\text{profit (increase)}}{\text{original}} \times \frac{100}{1} = \frac{8300}{6000} \times \frac{100}{1} = \underline{\underline{138.3\%}} \text{ (profit)}$$

This answer may look strange because it is more than 100% but you can see that their money has more than doubled so you would expect over 100%.

Reverse Percentages:

Sometimes you may be given the price of an item **after** a percentage increase or decrease and be asked to find the original price. This is not straightforward, as you would have to find a percentage of the original price (which you don't know yet). The following method can be used:

- Decide what new % is.
- **Find 1%** using the new price
- **x100** to find the original price (100%)

Remember:
Original price is always 100%.

Examples:

- **A picture is bought in a '20% off' sale. If the picture is on sale for £68, how much did it cost originally?**

(You cannot just find 20% of £68 and add it on. The sale is based on 20% of the original price that we don't know yet.)

- Decide what new % is: The sale price of the picture is 20% less than the original price so it must be $(100-20) = 80\%$ of the original.
So the new price (**£68**) is equal to **80%**.

$$80\% = £68$$

- Find 1%: $1\% = 68 \div 80 = 0.85$
- Find 100%: $100\% = 0.85 \times 100 = £85$

So the original price of the picture was **£85**.

(Check this is correct by finding 20% of £85 and subtracting it to see if you get £68.)

NB: the original amount is always 100%.

- **The value of a house has increased by 40% over the last 3 years. The house is now worth £126,000. How much was it worth 3 years ago?**

- Decide what new % is: If the value of the house has increased (gone up) by 40% it has gone up to $(100+40) = 140\%$ of the original.
So the new amount (**£126,000**) is equal to **140%**.

$$140\% = £126,000$$

- Find 1%: $1\% = £126,000 \div 140 = 900$
- Find 100%: $100\% = 900 \times 100 = £90,000$

So the original value of the house was £90,000.

(Check this by finding 40% of £90,000 and adding it on to see if you get £126,000.)