Compound interest is the term used to describe the way that interest builds upon itself over time.

If you save £100 at 4% interest per year, then in the first year you'll gain £4. That means the amount in the account is now £104, so rather than getting another £4 in the second year, you get 4% of £104, which is £4.16. There will then be £108.16 in your account, so in the third year you'll receive 4% interest on that, and so on.

There are a few different ways to calculate compound interest:

Method 1: step-by-step

Like the example above, in this method we calculate the interest one year at a time:

1. Calculate the interest accrued in the first year.

2. Add this to the total amount.

3. Calculate the interest accrued in the second year, based on this new amount.

4. Add this to the total amount.

5. Repeat for as many years as needed.

Of course, you may receive interest monthly/weekly etc., so replace the time frame with the appropriate amount for the problem you're working on.

Example

A loan is taken out for £2000. The lender charges 5% interest per month, and the borrower isn't going to make any payments for the first 3 months. How much will the borrower owe after those 3 months?

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Answer

1. 5% of £2000 is £100. If you are unsure of how to calculate a percentage, please see our percentages factsheet.

2. After the first month, the debt is at £2000 + £100 = £2100.

3. We now find 5% of £2100, which is £105.

4. After the second month, the debt is £2205.

5. Finally, we find 5% or £2205, which is £110.25.

6. The total amount of debt after 3 months is £2315.25.

This method is best for people who aren't very confident with using decimals to calculate percentages yet. It's a good way of practicing your percentage skills. When you are handling your own finances, this method may be better since you can make alterations at any stage if you add or take away from the pot of money.

The main issue with this method is that it takes a long time (think about if the earlier example had said "how much will be owed after 12 months?"- that would be a 24-part calculation!).

Method 2: using a formula

The formula for calculating compound interest is:

Total amount after "n" units of time = (original amount) x $(1 + \text{decimal interest})^n$

The steps are as follows:

1. Turn the percentage interest into a decimal by dividing the percentage by 100.

2. Add 1 to the decimal.

3. Calculate this value to the power of "n" ("n" is the number of units of time that the interest is calculated for- for example, a loan over 4 years with yearly interest has n = 4).

4. Multiply this number by the original amount of money.

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Example

£1500 is saved in an account that gives 3% interest each year. How much money will there be in the account after 5 years if there is no money added or taken out?

Answer

1. $3\% \div 100 = 0.03$

2. $0.03 + 1 = 1.03$

3. $(1.03)^5 = 1.1593$ (rounded)

4. £1500 x 1.1593 = £1738.95 (due to rounding, this amount may differ by a few pence between answers).

(Money should always be rounded to 2 decimal places to represent pence).

The reasoning behind this method is as follows:

When a year's interest is added, we add 3% to the original 100% in the savings account, meaning after one year, we have 103% of the original money (or 1.03 as a decimal). The calculation at this point is £1500 x 1.03 = £1545.

The next year, we find 103% of this new amount (i.e. multiply by 1.03 again). So, we have calculated £1545 x 1.03 = (£1500 x 1.03) x 1.03.

This keeps repeating until we've multiplied by 1.03 5 times: £1500 x 1.03 x 1.03 x 1.03 x 1.03 x 1.03, or in a more concise format: £1500 x 1.03^5.

This method is much quicker than the previous method but may feel less intuitive. If you're not sure, try doing the same question with both methods to make sure you get the same answer for both, and to see which one you prefer.

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A note about interest rates on savings accounts and loans

Usually, your real-life savings account or loan will have an annual interest rate, but the interest will be added monthly instead. When you are performing the calculation, make sure you divide your annual interest by 12 months first, to get the monthly interest rate. For example, if you have an annual interest rate of 4%, then you get 4% ÷ 12 months = 0.333% per month. So, if you saved £1000 in a 4% annual interest rate savings account that pays interest monthly for a year, you'd have:

£1000 x $(1.00333)^{12}$ = £1040.74

Usually exam questions are written with yearly interest being added, to avoid them being overly complex. When you are performing these calculations on your own real-life finances, remember to check how often the interest is paid.

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