



# CIE IGCSE Maths: Core



Your notes

## Simple & Compound Interest

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## Interest & Depreciation



Your notes

### Simple Interest

#### What is simple interest?

- Interest is extra money added every year (or month) to an original amount of money
- Simple interest** is interest that is the **same** amount each time
  - It can be good: for example, putting £100 into a bank account and the bank rewarding you with simple interest of 10% every year
    - After one year you'd have £110, after two years you'd have £120, ...
  - It can be bad: for example, owing £100 to a friend and they charge you simple interest of 10% for every year you don't pay them back
    - After the first year you'd owe them £110, after the second year you'd owe them £120, ...
- If £ $P$  is your initial amount of money and simple interest is added to it at a rate of  $R\%$  per year for  $T$  years, then the total amount of interest gained, £ $I$ , is given by the formula

$$I = \frac{PRT}{100}$$

- Remember that this formula calculates the **amount of simple interest** added over  $T$  years, not the total amount of money after  $T$  years
  - To find the total amount of money after  $T$  years, add the interest £ $I$  to the original amount £ $P$

#### Examiner Tip

- Exam questions will state "simple interest" clearly in the question, to avoid confusion with compound interest
- Pay attention to how some questions want the final answers (for example, to the nearest hundred)



Your notes

### Worked example

A bank account offers simple interest of 8% per year. I put £250 into this bank account for 6 years. Find

- (a) the amount of interest added over 6 years,
- (b) the total amount in my bank account after 6 years.

(a) Substitute  $P = 250$ ,  $R = 8$  and  $T = 6$  into the formula  $I = \frac{PRT}{100}$  to find the simple interest,  $I$

$$I = \frac{250 \times 8 \times 6}{100} = 120$$

**The amount of interest over 6 years is £120**

(b) The total amount after 6 years is the original amount, £250, plus the interest from part (a), £120

$$250 + 120$$

**The total amount in my bank account after 6 years is £370**



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## Compound Interest

### What is compound interest?

- Compound interest is where interest is paid on the interest from the previous year (or whatever time frame is being used), as well as on the original amount
- This is different from **simple interest** where interest is only paid on the original amount
  - Simple interest goes up by the same amount each time whereas compound interest goes up by an increasing amount each time

### How do you work with compound interest?

- Keep multiplying by the decimal equivalent of the percentage you want (the multiplier,  $p$ )
- A 25% increase ( $p = 1 + 0.25$ ) each year **for 3 years** is the same as multiplying by  $1.25 \times 1.25 \times 1.25$ 
  - Using powers, this is the same as  $\times 1.25^3$
- In general, the **multiplier**  $p$  applied  $n$  times gives an **overall** multiplier of  $p^n$
- If the percentages change varies from year to year, multiply by each one in order
  - a 5% increase **one year** followed by a 45% increase **the next year** is  $1.05 \times 1.45$
- In general, the multiplier  $p_1$  followed by the multiplier  $p_2$  followed by the multiplier  $p_3...$  etc gives an **overall** multiplier of  $p_1 p_2 p_3...$

### Compound interest formula

- Alternative method: A formula for the final ("after") amount is  $P \left( 1 + \frac{r}{100} \right)^n$  where...
  - ... $P$  is the original ("before") amount,  $r$  is the % increase, and  $n$  is the number of years
  - Note that  $1 + \frac{r}{100}$  is the same value as the multiplier

#### Examiner Tip

- It is easier to multiply by the decimal equivalent "raised to a power" than to multiply by the decimal equivalent several times in a row



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### Worked example

Jasmina invests £1200 in a savings account which pays compound interest at the rate of 2% per year for 7 years.

To the nearest pound, what is her investment worth at the end of the 7 years?

We want an increase of 2% per year, this is equivalent to a multiplier of 1.02, or 102% of the original amount

This multiplier is applied 7 times;

$$\times 1.02 \times 1.02 \times 1.02 \times 1.02 \times 1.02 \times 1.02 \times 1.02 = 1.02^7$$

Therefore the final value after 7 years will be

$$\pounds 1200 \times 1.02^7 = \pounds 1378.42$$

Round to the nearest pound

**£ 1378**

#### Alternative method

Or use the formula for the final amount  $P\left(1 + \frac{r}{100}\right)^n$

Substitute  $P$  is 1200,  $r = 2$  and  $n = 7$  into the formula

$$1200\left(1 + \frac{2}{100}\right)^7$$

**£1378 (to the nearest pound)**



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## Depreciation

### What is meant by depreciation?

- Depreciation is where an item loses value over time
  - For example: cars, game consoles, etc
- Depreciation is usually calculated as a percentage decrease at the end of each year
  - This works the same as compound interest, but with a percentage **decrease**

### How do I calculate a depreciation?

- You would calculate the new value after depreciation using the same method as compound interest
  - Identify the multiplier,  $p$  (1 - "% as a decimal")
    - 10% depreciation would have a multiplier of  $p = 1 - 0.1 = 0.9$
    - 1% depreciation would have a multiplier of  $p = 1 - 0.01 = 0.99$
  - Raise the multiplier to the power of the number of years (or months etc)
    - $p^n$
  - Multiply by the starting value
- New value is  $A \times p^n$ 
  - $A$  is the starting value
  - $p$  is the multiplier for the depreciation
  - $n$  is the number of years

- Alternative method: A formula for the final ("after") amount is  $P\left(1 - \frac{r}{100}\right)^n$  where...
  - ... $P$  is the original ("before") amount,  $r$  is the % decrease, and  $n$  is the number of years
- If you are asked to find the amount the value has depreciated by:
  - Find the difference between the starting value and the new value



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### Worked example

Mercy buys a car for £20 000. Each year its value depreciates by 15%.

Find the value of the car after 3 full years.

Identify the multiplier

$$100\% - 15\% = 85\%$$

$$p = 1 - 0.15 = 0.85$$

Raise to the power of number of years

$$0.85^3$$

Multiply by the starting value

$$£20\,000 \times 0.85^3$$

$$= \mathbf{£12\,282.50}$$

Alternative method

Or use the formula for the final amount  $P\left(1 - \frac{r}{100}\right)^n$

Substitute  $P$  is 20 000,  $r = 15$  and  $n = 3$  into the formula

$$20\,000\left(1 - \frac{15}{100}\right)^3$$

$$\mathbf{£12\,282.50}$$