Your notes

GCSE Maths: revision notes

Growth and decay

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Growth and decay

- Repeated percentage change: amount = starting amount × **multiplier**^{n}, where n is the number of times it changes.
- **Growth** uses a **multiplier** greater than 1. **Decay** uses a multiplier between 0 and 1.
- 2000 bacteria grow by 15% an hour. After 4 hours there are $2000 \times 1.15^4 = 3498$ (to the nearest whole number).

Finding the number of years

- Keep multiplying until you pass the target. £1000 at 6% compound interest is worth £1898.30 after 11 years and £2012.20 after 12 years, so it first doubles after 12 years.

Finding the rate

- A value goes from 400 to 484 in 2 years, changing by the same percentage each year. The **multiplier** squared is $484 \div 400 = 1.21$, so the **multiplier** is 1.1 and the rate is 10% a year.

Other repeated processes

- Some processes follow a rule such as $P_{n+1} = 1.2P_n - 50$. Start with P_0 and apply the rule again and again.
- A lake has 500 fish: $P_1 = 1.2 \times 500 - 50 = 550$, and $P_2 = 1.2 \times 550 - 50 = 610$.
- Something that halves every hour has a **multiplier** of 0.5 each hour: after 3 hours, 1/8 is left.

Worked examples

£2000 is invested at 3% compound interest a year. How much is there after 4 years?

The multiplier for 3% growth is 1.03. **1.03**

Amount = starting amount × multiplier to the power of the number of years. **2000×1.03^4**

Use your calculator. **$2000 \times 1.12550... = 2251.0176...$**

Round to the nearest penny. **£2251.02**

Answer: £2251.02

Key terms

Growth	An increase by the same percentage each time period.
Decay	A decrease by the same percentage each time period.
Multiplier	The number you multiply by for each change, such as 1.15 or 0.88.
Exponential growth	Growth where the amount is multiplied by the same number each time.
Half-life	The time taken for an amount to halve.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. Which multiplier represents growth of 15% a year?
2. Which multiplier represents decay of 8% a year?
3. 2000 bacteria grow by 15% an hour. How many are there after 4 hours, to the nearest whole number?
4. A car is worth £20 000 and loses 12% of its value each year. Which calculation gives its value after 5 years?
5. A value goes from 400 to 484 in 2 years, rising by the same percentage each year. What is the yearly rate?
6. £1000 is invested at 6% compound interest. After how many whole years does it first double?
7. $P_{n+1} = 1.2P_n - 50$ and $P_0 = 500$. What is P_1?
8. $P_{n+1} = 1.2P_n - 50$ and $P_0 = 500$. What is P_2?

Answers

1. 1.15
2. 0.92
3. 3498
4. $20\,000 \times 0.88^5$
5. 10%

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6. 12
7. 550
8. 610

What to do next

Practise 12 questions on this topic

Try 6 exam questions, with mark schemes

Read the lesson, one step at a time

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