INFOGRAPHHUB SERIES · 8 PARTS · AGES 13–99

Compound Interest and Saving

Eight infographics on how interest earns interest: the maths of saving, borrowing and the slow work of time.

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Each part is one printable infographic. Work through them in order, or use the part you need. The quiz answers are printed upside down at the foot of the quiz. Sources for every part are listed on its page at infographhub.com.

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COMPOUND INTEREST AND SAVING PART 1 OF 8 · AGES 13+

Compound Interest Explained

Why 1,000 at an example 8% a year grows to over 10,000 in 30 years with compounding, but only 3,400 with simple interest.

1,000 at an example 8% a year for 30 years



Compound: A = P(1 + R/100)^n, interest added once a year. Simple: A = P(1 + Rn/100). P = 1,000 in any currency, R = 8 (example rate), n = years.

10,062.66

Total with compound interest

1,000 after 30 years at an example 8% a year, added once a year.

3,400

Total with simple interest

Same deposit, rate and 30 years, but interest only on the original sum.

6,662.66

Extra earned by compounding

The gap after 30 years: interest earned on earlier interest.

745.38

Interest earned in year 30 alone

8% of a balance of 9,317.27. In year 1 the same rate earned just 80.

A fixed rate is an assumption

Real savings rates change, and investments have no guaranteed return. This page explains the maths: it is financial education, not financial advice.

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2. How to Calculate Compound Interest: Worked Examples

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COMPOUND INTEREST AND SAVING PART 2 OF 8 · AGES 13+

How to Calculate Compound Interest

Three worked examples: year by year, with a multiplier, and with the formula for monthly compounding. Every rate here is an example.

1 Year by year

1,000 is saved at an example rate of 5% a year, added once a year. How much is there after 3 years?

1. Year 1: 5% of 1,000 = 50, so 1,000 + 50 = 1,050
2. Year 2: 5% of 1,050 = 52.50, so 1,050 + 52.50 = 1,102.50
3. Year 3: 5% of 1,102.50 = 55.125, so 1,102.50 + 55.125 = 1,157.625
4. Round money to 2 decimal places at the end: 1,157.63
5. Interest earned = 1,157.63 − 1,000 = 157.63

ANSWER **1,157.63 after 3 years, of which 157.63 is interest**

2 Use a multiplier

2,500 is saved at an example rate of 4% a year, added once a year, for 10 years. Find the final amount.

1. A 4% increase means multiplying by 1 + 0.04 = 1.04
2. Ten years means multiplying by 1.04 ten times: 1.04^10
3. 1.04^10 = 1.480244… (keep every digit)
4. A = 2,500 × 1.480244… = 3,700.61
5. Check the method: 1,000 × 1.05^3 = 1,157.63, the same as Example 1

ANSWER **3,700.61 after 10 years**

3 Monthly: A = P(1 + r/n)^(nt)

1,000 is saved at an example rate of 6% a year, with interest added monthly, for 3 years. Find the final amount A.

1. P = 1,000, r = 6% = 0.06, n = 12 times a year, t = 3 years
2. Rate for each month: r/n = 0.06 ÷ 12 = 0.005
3. Number of months: nt = 12 × 3 = 36
4. A = 1,000 × 1.005^36 = 1,000 × 1.196680… = 1,196.68
5. Added once a year instead: 1,000 × 1.06^3 = 1,191.02, so monthly gives 5.66 more

ANSWER **1,196.68 after 3 years**

Round only at the end

Keep every digit on your calculator until the final step, then round money to 2 decimal places. To find just the interest, subtract the starting amount: interest = A − P.

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3. Simple vs Compound Interest: What Is the Difference?

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COMPOUND INTEREST AND SAVING · PART 3 OF 8 · AGES 13+

Simple vs Compound Interest

The same 1,000 at the same example rate of 5% a year, worked out both ways. The only difference is what the interest is calculated on.

Simple	Compound
INTEREST IS WORKED OUT ON	
Only the original 1,000 (the principal), every single year.	The principal plus all the interest added so far.
FORMULA, ADDED YEARLY	
A = P(1 + rt), so A = 1,000 × (1 + 0.05t)	A = P(1 + r)^t, so A = 1,000 × 1.05^t
INTEREST IN YEAR 2	
50, exactly the same as in year 1.	52.50, because it is 5% of 1,050.
AFTER 10 YEARS	
1,500 (500 of interest)	1,628.89 (628.89 of interest)
AFTER 20 YEARS	
2,000 (1,000 of interest)	2,653.30 (1,653.30 of interest)
SHAPE OF THE GRAPH	
A straight line: linear growth, the same amount added each year.	A curve that gets steeper: exponential growth, the same factor each year.

When interest is paid out

If interest is paid out to you instead of being added to the balance, the balance grows like simple interest. Compounding only happens when the interest stays in and starts earning interest too.

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4. The Rule of 72: How Long Does Money Take to Double?

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The Rule of 72

A quick way to estimate how long a balance takes to double, checked against the exact answer at six example rates.

72 ÷ rate

≈ years for money to double at a fixed yearly rate

Divide 72 by the rate in per cent. It is a mental shortcut, not an exact formula.

36 years

to double at an example 2% a year (72 ÷ 2)

Exact: 35.00 years. At low rates the rule comes out a little too high.

18 years

to double at an example 4% a year (72 ÷ 4)

Exact: 17.67 years.

12 years

to double at an example 6% a year (72 ÷ 6)

Exact: 11.90 years.

9 years

to double at an example 8% a year (72 ÷ 8)

Exact: 9.01 years. Around 8% the rule is almost spot on.

8 years

to double at an example 9% a year (72 ÷ 9)

Exact: 8.04 years.

6 years

to double at an example 12% a year (72 ÷ 12)

Exact: 6.12 years. At higher rates the rule comes out a little too low.

Only an approximation

The rule assumes one fixed rate with interest added once a year. Real rates change and investment returns are not guaranteed. Exact doubling time = log 2 ÷ log(1 + r).

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5. Compound Interest Key Terms: APR, AER, APY and More

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Compound Interest Key Terms

The words and letters you need to read a compound interest question, a savings rate or a loan offer, each with a one-line meaning.

The building blocks

`Principal (P)`	The amount you start with: the money first saved, invested or borrowed. Interest is worked out from it.
`Interest`	Money paid for the use of money. A saver earns it; a borrower is charged it. It is usually quoted as a percentage per year.
`Interest rate (r)`	The percentage of the balance paid as interest in a year, such as an example 5%. In a formula, write it as a decimal: 0.05.
`Period and term (t)`	A period is the time between interest payments, such as a month. The term is the whole length of time, usually in years.
`Compounding frequency (n)`	How many times a year interest is added to the balance: 1 for yearly, 4 for quarterly, 12 for monthly, 365 for daily.
`A = P(1 + r/n)^(nt)`	The final amount A after t years, when interest at a yearly rate r is added n times a year to a principal P.

Rates you will see

`Nominal (gross) rate`	The headline yearly rate before compounding is counted. An example 6% a year added monthly is 0.5% a month.
`APR`	Annual percentage rate: the yearly cost of borrowing on loans and cards. It usually includes some fees, and the exact rules differ by country.
`AER`	Annual equivalent rate, the UK name for a savings rate shown as if interest were paid and compounded once a year, so accounts compare fairly.
`APY`	Annual percentage yield, the US name for the same idea: the yearly interest on savings including compounding. 6% added monthly is 6.17% APY.
`Fixed and variable rates`	A fixed rate stays the same for an agreed time; a variable rate can go up or down. Most textbook examples assume a fixed rate.

What money is really worth

`Inflation`	The rate at which prices rise. At 2% inflation, a basket of shopping that cost 100 a year ago costs 102 today.
`Purchasing power`	How much a sum of money can actually buy. Inflation lowers it over time, even when the number in an account stays the same.
`Real return`	Growth after allowing for inflation. Roughly the interest rate minus inflation; exactly (1 + rate) ÷ (1 + inflation) − 1.

Two names, one idea

AER (used in the UK) and APY (used in the US) both show the yearly rate after compounding. That is why an example 6% a year added monthly appears as 6.17%.

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6. Compound Interest in Everyday Life

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COMPOUND INTEREST AND SAVING PART 6 OF 8 · AGES 13+

Compound Interest in Everyday Life

Where compounding helps savers, where it works against borrowers, and where the same maths makes things shrink. All numbers are illustrations.

Savings accounts

Interest added to a savings balance earns interest too. At an example 3% a year, 1,000 becomes 1,030 after a year and 1,343.92 after 10 years.

Loans

A borrower pays interest on whatever is still owed. Repayments shrink the balance; interest that is added and not paid makes the debt grow like savings do.

Credit card debt

Many cards add interest daily. At an example 20% APR, 1,000 left unpaid with no payments would grow to about 1,221.34 in a year: compounding working against you.

Student loans

Many student loan schemes charge interest. In some, such as England's, it is added from the first payment, even while you study. The rules differ widely by country.

Inflation eating savings

Rising prices compound too. At an example 3% inflation, 1,000 kept as cash for 10 years would buy only what about 744 buys today.

Starting early vs late

1,000 left at an example 5% a year for 40 years grows to 7,039.99; left for 20 years it reaches 2,653.30. The extra 20 years more than doubles the result.

Things that lose value

Compounding can shrink things too. A car worth 10,000 that loses an example 15% of its value each year is worth 6,141.25 after 3 years.

Same maths, both directions

Compounding helps when you are the one earning interest and hurts when you are the one paying it. These numbers are illustrations of the maths, not predictions or financial advice.

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7. Common Compound Interest Mistakes and How to Avoid Them

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COMPOUND INTEREST AND SAVING · PART 7 OF 8 · AGES 13+

Common Compound Interest Mistakes

Five slips that catch students and adults alike, each with the wrong working, the right working and the reason. All rates are examples.

1 Adding the same interest every year

WRONG

~~1,000 at 5% a year for 3 years: 1,000 + 3 × 50 = 1,150.~~

RIGHT

1,000 × 1.05³ = 1,157.63.

That is simple interest. With compounding, each year's interest is worked out on the new balance, so it grows: 50, then 52.50, then 55.13.

2 Forgetting to turn the % into a decimal

WRONG

~~5% for 3 years: 1,000 × (1 + 5)³ = 216,000.~~

RIGHT

5% = 5 ÷ 100 = 0.05, so 1,000 × (1 + 0.05)³ = 1,157.63.

In the formula, r must be a decimal. Using 5 instead of 0.05 means a 500% rise every year, which no sensible answer for 3 years at 5% could show.

3 Mixing a yearly rate with monthly periods

WRONG

~~6% a year, added monthly, for 2 years: 1,000 × 1.06^24 = 4,048.93.~~

RIGHT

Monthly rate = 0.06 ÷ 12 = 0.005, so 1,000 × 1.005^24 = 1,127.16.

The rate and the number of periods must match. Counting in months means using the monthly rate r/n; using the yearly rate means counting in years.

4 Comparing unlike rates (APR, gross, AER)

WRONG

~~Account A pays 4.9% a year, added monthly. Account B pays 5% AER. B pays more, because 5 > 4.9.~~

RIGHT

A's AER = (1 + 0.049 ÷ 12)^12 − 1 = 5.01%, so A pays slightly more.

Compare like with like: AER with AER (APY with APY), APR with APR. A gross rate leaves out compounding, and an APR is a borrowing cost that can include fees.

5 Ignoring inflation

WRONG

~~My savings grew by 3% this year, so they buy 3% more.~~

RIGHT

With 4% inflation: 1.03 ÷ 1.04 − 1 ≈ −0.96%, so they buy about 1% less.

A bigger number is not the same as more buying power. The real return is roughly the interest rate minus inflation, and exactly the ratio of the two multipliers.

Sense-check every answer

Estimate first: 3 years at 5% should add a little more than 15%. Compound interest is always a little more than simple interest at the same rate, never hundreds of times more.

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8. Compound Interest Quiz: Test Yourself

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COMPOUND INTEREST AND SAVING · PART 8 OF 8 · AGES 13+

Compound Interest Quiz

Ten questions on the whole series. Every rate is an example. Answer them all, then turn the page round to check.

1 **What is compound interest?**

- A Interest on the original amount only
- B Interest on the original amount and earlier interest
- C A fee for opening an account
- D Interest that is paid only once

2 **1,000 is saved at an example 10% a year, added once a year. How much is there after 2 years?**

- A 1,020
- B 1,100
- C 1,200
- D 1,210

3 **What is the simple interest on 500 at an example 4% a year for 3 years?**

- A 20
- B 60
- C 62.43
- D 560

4 **Interest at an example 6% a year is added monthly. What is the interest rate for each month?**

- A 6%
- B 0.6%
- C 0.5%
- D 72%

5 **Using the Rule of 72, roughly how long does money take to double at an example 6% a year?**

- A 6 years
- B 12 years
- C 18 years
- D 72 years

6 **Which rate is designed for comparing savings accounts fairly?**

- A APR
- B AER (called APY in the US)
- C The inflation rate
- D The daily periodic rate

7 **Savings earn an example 2% a year while prices rise by 3% a year. What happens to what the savings can buy?**

- A It rises by 5%
- B It rises by 2%
- C It stays the same
- D It falls by about 1%

8 **Which graph shape shows a balance growing with compound interest over many years?**

- A A straight line
- B A curve that gets steeper
- C A flat line
- D A curve that levels off

9 **Write 1,000 × 1.05 × 1.05 × 1.05 using a power, then work it out to 2 decimal places.**

.....

10 **Why can an unpaid credit card balance grow by more than its APR in a year?**

.....

ANSWERS

1. B: Interest on the original amount and on earlier interest
2. D: 1,210 (1,000 × 1.1²)
3. B: 60 (500 × 0.04 × 3). £62.43 would be compound interest
4. C: 0.5% (6 ÷ 12)
5. B: About 12 years (72 ÷ 6). The exact answer is 11.90 years
6. B: AER, or APY in the US: the yearly rate after compounding
7. D: It falls by about 1% (1.02 ÷ 1.03 − 1 ≈ −0.97%)
8. B: A curve that gets steeper (exponential growth)
9. 1,000 × 1.05³ = 1,157.63
10. Interest is often added daily and then charged interest too. At an example 20% APR, an unpaid balance grows about 22.13% in a year.

SERIES COMPLETE

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