

# Simple & Compound Interest

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Interest questions are about how money changes over time. Simple interest grows by the same amount each period, while compound interest grows on the new total each period.

In CSEC, the hardest part is often choosing the correct model before substituting into a formula. Identify the principal, rate, time, and whether the question involves growth or decrease. Then explain whether you are finding interest only, final amount, appreciation, or depreciation.

Interest is the money a bank PAYS YOU for keeping your money with them (or money YOU PAY the bank for borrowing money).

## Understanding Simple Interest

**Principal (P):** The original amount of money.

**Rate (R):** The percentage of interest per year (usually written as % per annum, or % p.a.).

**Time (T):** How long the money is invested or borrowed, in years.

**Interest (I):** The money earned or paid.

**Amount (A):** The total after adding interest to principal.

## Simple Interest Formula

In **simple interest**, the interest is calculated only on the ORIGINAL principal, not on accumulated interest.

$$I = \frac{P \times R \times T}{100}$$

$$A = P + I = P + \frac{P \times R \times T}{100}$$

Or combined:

$$A = P \left( 1 + \frac{R \times T}{100} \right)$$

**Remember**

Simple interest = same interest every year, based on the original amount only.

**Example**

**You invest 1000 dollars at 5% per annum for 3 years. How much interest do you earn?**

**Step 1:** Identify values

- $P = 1000$  dollars
- $R = 5\%$  per annum
- $T = 3$  years

**Step 2:** Use formula

$$I = \frac{P \times R \times T}{100} = \frac{1000 \times 5 \times 3}{100}$$

**Step 3:** Calculate

$$I = \frac{15000}{100} = \$150$$

**Step 4:** Find amount

$$A = P + I = 1000 + 150 = \$1150$$

After 3 years, you have **1150 dollars** (earned **150 dollars** interest).

**Each year**, you earn exactly 50 dollars interest:

- Year 1:  $1000 + 50 = 1050$  dollars
- Year 2:  $1050 + 50 = 1100$  dollars
- Year 3:  $1100 + 50 = 1150$  dollars

The interest is the **SAME** every year!

 **Example**

**You borrow 2000 dollars at 8% per annum for 2 years. How much total will you owe?**

**Step 1:** Identify values

- P = 2000 dollars
- R = 8% per annum
- T = 2 years

**Step 2:** Calculate interest

$$I = \frac{2000 \times 8 \times 2}{100} = \frac{32000}{100} = \$320$$

**Step 3:** Calculate total

$$A = 2000 + 320 = \$2320$$

You owe **2320 dollars** (interest is **320 dollars**).

## Finding Missing Values in Simple Interest

Sometimes you know the amount, rate, and time, but need to find the principal or rate.

**Example**

An investment of  $P$  at 6% per annum for 4 years earns 240 dollars in interest. Find  $P$ .

**Step 1:** Use the formula

$$I = \frac{P \times R \times T}{100}$$

**Step 2:** Substitute

$$240 = \frac{P \times 6 \times 4}{100}$$

**Step 3:** Simplify

$$240 = \frac{24P}{100}$$

**Step 4:** Multiply both sides by 100

$$24000 = 24P$$

**Step 5:** Divide by 24

$$P = \frac{24000}{24} = \$1000$$

The principal was 1000 dollars.

**Check:**

$$I = \frac{1000 \times 6 \times 4}{100} = \frac{24000}{100} = \$240$$

**Exam Tip**

**For simple interest problems on CSEC exams:**

- 1. Always convert time to YEARS (if given in months, divide by 12)
- 2. Always use the formula  $I = \frac{P \times R \times T}{100}$
- 3. Make sure rate is per annum (per year)
- 4. Show all steps clearly

## Compound Interest

Compound interest is when interest is calculated not just on the original principal, but on the interest you've already earned. It's "interest on interest."

## Understanding Compound Interest

The key difference: **with compound interest, each year you earn interest on a LARGER amount** (principal + previous interest).

### Compound Interest Formula

$$A = P \left( 1 + \frac{R}{100} \right)^T$$

Where:

- A = Final amount
- P = Principal
- R = Rate per annum (%)
- T = Time in years

**Interest earned** =  $A - P$

#### Remember

Compound interest grows faster than simple interest because you earn interest on the interest!

**Example**

You invest 1000 dollars at 5% per annum for 3 years with compound interest. Find the final amount.

**Step 1:** Identify values

- $P = 1000$  dollars
- $R = 5\%$
- $T = 3$  years

**Step 2:** Use formula

$$A = P \left( 1 + \frac{R}{100} \right)^T = 1000 \left( 1 + \frac{5}{100} \right)^3$$

**Step 3:** Simplify the bracket

$$A = 1000(1.05)^3$$

**Step 4:** Calculate  $(1.05)^3$

$$1.05 \times 1.05 = 1.1025$$

$$1.1025 \times 1.05 = 1.157625$$

**Step 5:** Multiply by principal

$$A = 1000 \times 1.157625 = \$1157.63$$

**Step 6:** Interest earned

$$I = 1157.63 - 1000 = \$157.63$$

After 3 years, you have 1157.63 dollars (earned 157.63 dollars interest).

Compare to simple interest: Only 150 dollars! Compound interest earned 7.63 dollars extra.

## Year-by-Year Breakdown

Let's see how compound interest actually works:

Year	Principal at Start	Interest Earned	Total at End
1	1000.00 dollars	50.00 dollars	1050.00 dollars
2	1050.00 dollars	52.50 dollars	1102.50 dollars
3	1102.50 dollars	55.13 dollars	1157.63 dollars

Notice: Each year, interest is calculated on the PREVIOUS year's total!

**Example****Compare simple vs. compound interest:****Investment:** 2000 dollars at 8% per annum for 2 years**Simple Interest:**

$$I = \frac{2000 \times 8 \times 2}{100} = \$320$$

$$A = \$2320$$

**Compound Interest:**

$$A = 2000 \left(1 + \frac{8}{100}\right)^2 = 2000(1.08)^2$$

$$A = 2000 \times 1.1664 = \$2332.80$$

$$I = 2332.80 - 2000 = \$332.80$$

**Difference:** Compound interest earns 12.80 dollars extra!

Over longer times, this difference grows MUCH larger.

## Appreciation and Depreciation

Not all money grows through interest. Some assets (things you own) increase or decrease in value over time.

### Appreciation

**Appreciation:** When something INCREASES in value over time.

Example: Property, artwork, classic cars.

Formula (same as compound interest):

$$V = P \left(1 + \frac{R}{100}\right)^T$$

Where V = final value, P = initial value, R = rate of appreciation per annum, T = time in years.

**Example**

A house is bought for 150,000 dollars. It appreciates at 6% per year. What's it worth after 5 years?

**Step 1:** Identify values

- $P = 150,000$  dollars
- $R = 6\%$
- $T = 5$  years

**Step 2:** Use formula

$$V = 150000 \left( 1 + \frac{6}{100} \right)^5 = 150000(1.06)^5$$

**Step 3:** Calculate  $(1.06)^5$

$$(1.06)^5 = 1.3382$$

**Step 4:** Multiply

$$V = 150000 \times 1.3382 = \$200,730$$

The house is worth 200,730 dollars (gained 50,730 dollars value).

## Depreciation

**Depreciation:** When something DECREASES in value over time.

Example: Cars, computers, furniture.

Formula:

$$V = P \left( 1 - \frac{R}{100} \right)^T$$

Note the MINUS sign in the bracket!

 **Example**

A car is bought for 30,000 dollars. It depreciates at 15% per year. What's it worth after 3 years?

**Step 1:** Identify values

- $P = 30,000$  dollars
- $R = 15\%$  (depreciation rate)
- $T = 3$  years

**Step 2:** Use formula

$$V = 30000 \left( 1 - \frac{15}{100} \right)^3 = 30000(0.85)^3$$

**Step 3:** Calculate  $(0.85)^3$

$$(0.85)^3 = 0.6141$$

**Step 4:** Multiply

$$V = 30000 \times 0.6141 = \$18,423$$

The car is worth 18,423 dollars (lost 11,577 dollars value).

 **Remember**

- **Appreciation formula** :  $V = P \left( 1 + \frac{R}{100} \right)^T$
- **Depreciation formula** :  $V = P \left( 1 - \frac{R}{100} \right)^T$

The ONLY difference is + or - in the bracket!