# 🟢 Exponential Growth

Used when the value **increases** over time — like **population**, **investment**, or **inflation**.

## 📌 Example 1: Population Growth

> A town has a population of 20,000. It increases by 4% each year.
> What will the population be after 3 years?

**Step 1: Identify values**

- Initial = 20,000
- Rate = 4% → $r = 0.04$
- Time = 3 years

$$\text{Population} = 20000 \times (1 + 0.04)^3 = 20000 \times (1.04)^3$$

$$= 20000 \times 1.124864 = \boxed{22,497.28}$$

➡️ So, after 3 years, the population will be **about 22,497 people**.

# 🔻 Exponential Decay

Used when the value **decreases** over time — like **depreciation**, **cooling**, or **radioactive decay**.

## 📌 Example 2: Car Depreciation

> A car is bought for $15,000. It loses 10% of its value each year.
> What is its value after 4 years?

**Step 1: Identify values**

- Initial = 15,000
- Rate = 10% → $r = 0.10$
- Time = 4 years

$$\text{Value} = 15000 \times (1 - 0.10)^4 = 15000 \times (0.90)^4$$

$$= 15000 \times 0.6561 = \boxed{9841.50}$$

➡️ So, after 4 years, the car is worth **$9,841.50**.

# 🧠 Tips and Tricks

- For **growth**, values get **larger** over time.
- For **decay**, values get **smaller** over time.
- Always convert percentage to **decimal** (divide by 100).
- Round your final answers to **2 decimal places** or as instructed.

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## 📌 Example 3: A tricky depreciation

> A machine is worth $8,000 and depreciates by 12% per year.
> What will its value be after 5 years?

$$= 8000 \times (1 - 0.12)^5 = 8000 \times (0.88)^5 = 8000 \times 0.5277 = \boxed{4221.60}$$

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## 📌 Example 4: Compound Interest Style Growth

> You invest $1,200 at a 6% interest rate per year, compounded annually.
> What will it be worth after 3 years?

$$= 1200 \times (1 + 0.06)^3 = 1200 \times 1.191016 = \boxed{1,429.22}$$

# 📘 Exponential Growth and Decay

Exponential growth or decay happens when **a quantity increases or decreases by a fixed percentage over regular time intervals**.

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## 🔑 Key Formula

$$\text{Final Amount} = \text{Initial Amount} \times (1 \pm r)^n$$

Where:

- $r$ = growth or decay rate **as a decimal** (e.g. 5% = 0.05)
- $n$ = number of time periods (e.g. years, months)
- Use $+r$ for **growth**
- Use $-r$ for **decay**