

Money 4

This class contains compound interest.

Compound Interest

Principal = the amount of money put into the bank.

Interest = the money made on my principal.

Time = the length of time in years that the principal is in the bank.

Rate = the rate of interest - a percentage of the principal

In the case of Simple interest we just follow the formula

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

The important point about Compound Interest is that at the end of year interest is added to the principal to give us the Amount so $A=P+I$.

Given the Principal and asked to find the Amount or Interest

Example 1 €9,000 is invested for 2 years compound interest. The rate of interest in the first year was 5%, the second year at 6.5%. Calculate the total interest earned.

Year 1: $P = 9000$, $R = 5$

$$\text{Interest} = \frac{PR}{100} = \frac{9000 \times 5}{100} = 450$$

$$A = P + I$$

$$A = 9000 + 450 = 9450$$

Year 2: $P = 9450$, $R = 6.5$

$$\text{Interest} = \frac{9450 \times 6.5}{100} = 614.25$$

Total interest = interest in year 1 + interest in year 2

$$= 450 + 614.25 = \text{€}1064.25$$

Example 2 €4,500 is borrowed for 2 years at 8% per annum. If €1,200 is paid back at the end of the first year how much is owed at the end of the second year.

We use the same methods as above. We must read the question.

Year 1: $P = 4500, R = 8$

$$\text{Interest} = \frac{PR}{100} = \frac{4500 \times 8}{100} = 360$$

$$A = P + I$$
$$A = 4500 + 360 = 4860$$

At the end of the year €1,200 is paid back so principal for year 2 will be $4860 - 1200 = 3660$

Year 2: $P = 3660, R = 8$

$$\text{Interest} = \frac{3660 \times 8}{100} = 292.80$$

$$A = 3660 + 292.80 = \text{€}3,952.80$$

Note Per annum means per year.

Given the Amount and asked to find the Principal

Example 3 A sum of money invested at compound interest amounts to €1,984.50 after two years at 5% per annum. Calculate the sum invested.

Must start at year 2 and work backwards.

In terms of percentages we start the year with 100% and in this question we gained 5%, so that at the end of the year we had 105% of what we started the year with.

$$\begin{aligned} \text{Year 2: } 105\% &= 1984.50 \\ 1\% &= 18.9 \\ 100\% &= 1890 \end{aligned}$$

$$\begin{aligned} \text{Year 1: } 105\% &= 1890 \\ 1\% &= 18 \\ 100\% &= 1800 \end{aligned}$$

The original amount was €1800

To find the Rate of Interest

Example 4 A sum of money €40,000, is invested for 3 years at compound interest. The rate of interest for year 1 is 10% and for year 2 is also 10%. Calculate how much the invested money amounts to at the end of year 2.

At the end of year 3, the invested money amounted to €51,667. Calculate the rate of interest for year 3.

Year 1: $P = 40,000$, $R = 10$

$$\text{Interest} = \frac{PR}{100} = \frac{40000 \times 10}{100} = 4000$$

$$A = P + I \\ A = 40000 + 4000 = 44000$$

Year 2: $P = 44000$, $R = 10$

$$\text{Interest} = \frac{44000 \times 10}{100} = 4400$$

$$A = 44000 + 4400 = 48400$$

Year 3: $P = 48400$, $A = 51667$

Interest = amount – principal

$$= 51667 - 48400 = 3267$$

$$\text{Percentage interest} = \frac{\text{interest}}{\text{principal}} \times \frac{100}{1} = \frac{3267}{48400} \times \frac{100}{1} = 6.75\%$$

Given the Interest to find the Principal

Example 5 How much money must be invested for 2 years compound interest at 8% per annum in order to earn €777.60 in interest in the second year.

When the principal is unknown as in this question let the principal be €100 and continue.

Year 1: $P = 100, R = 8$

$$\text{Interest} = \frac{PR}{100} = \frac{100 \times 8}{100} = 8$$

$$A = 108$$

Year 2: $P = 108, R = 8$

$$\text{Interest} = \frac{PR}{100} = \frac{108 \times 8}{100} = 8.64$$

This means for every €100 invested we gain €8.64 in interest in the second year.

The number of €100 that we must invest is therefore given by $\frac{777.6}{8.64} = 90$

The amount we must invest is €9000

Example 6 A sum of money €5,900, is invested for one year. The rate of interest is 8%. Calculate how much the invested money amounts to at the end of year 1.

A charge of € x was then deducted from this amount. The money, which remained, was converted into dollars and the dollars were invested for a year at a rate of interest of 9% per annum.

At the end of the year the, the invested dollars amounted to \$10,137.

If the exchange was €1=\$1.50 on the day the euros were changed into dollars, calculate x .

Year 1: $P = 5900$, $R = 8$

$$\text{Interest} = \frac{PR}{100} = \frac{5900 \times 8}{100} = 472$$

$$A = P + I$$

$$A = 6372$$

Year 2: Need to work backwards since we have the amount.

$$109\% = 10137$$

$$1\% = 93.8611$$

$$100\% = 9386.11$$

Now convert the dollars to euros

$$\$9,386.11 = \frac{9386.11}{1.5} = \text{€}6257.40$$

$$x = 6372 - 6257.40 = \text{€}114.60$$