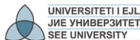


# Mathematics of Finance

## Proportions and Percentages. Simple Interest

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# Aims and Objectives

- Solving a proportion for an unknown.
- Percentual calculus.
- Calculating simple interest.

# Contents

1 Proportions and Percentages

2 Simple Interest

# Proportions

- Two quantities are said to be *proportional* if they have a constant ratio;  
e.g.,  $\frac{10}{4}$  is the same as  $\frac{5}{2}$ .
- Equality of two ratios is called a *proportion*:

$$\frac{a}{b} = \frac{c}{d}.$$

- A proportion  $\frac{a}{b} = \frac{c}{d}$  holds if and only if  $ad = bc$ .

## Proportions. (Continued)

### Example

Solve the following equation

$$\frac{5}{x} = \frac{25}{12}.$$

### Proof.

The given proportion is equivalent to the following equation

$$25x = 5 \cdot 12$$

$$x = \frac{5 \cdot 12}{25} = 2.4.$$



# Percentage

## Percentage

- The quantities related to computing a percentage are:
  - ① *Principal* (*present value*)  $P$  is the quantity ("the total") out of which a part is calculated based on a percentage.
  - ② *Percentage*  $p$  represents the one hundreds of the principal.
  - ③ *Interest*  $I$  is "the fraction" of the total calculated based on the percentage.
- The relationship between these is given by the proportion

$$\frac{P}{I} = \frac{100}{p},$$

- Symbolically, a percentage  $p$  is denoted by  $p\%$ .

## Percentage. (Continued)

### Example

A price of 380 € of a product is decreased by 5%.  
What is the interest  $I$  and the new price?

### Proof.

Given  $P = 380$ ,  $p = 5$ , we need  $I$  and  $P - I$ .

$$I = \frac{P \cdot p}{100} = \frac{380 \cdot 5}{100} = 19.$$

The new price will be

$$P - I = 380 - 19 = 361$$

euros.



## Percentage. (Continued)

### Example

If 18% sugar is obtained from sugar beet  
how many kilograms of the sugar beets are needed  
for 13,113 kilograms of sugar?

### Proof.

Here, we have  $p = 18$ ,  $I = 13,113$ ;  $P$  is needed.  
From the percentual proportion we find

$$P = \frac{I \cdot 100}{p} = \frac{13,113 \cdot 100}{18} = 72,850$$

kilograms.





# Simple Interest

## Simple Interest

An interest  $I$  on a principal  $P$  with an annual simple interest rate  $p\%$  is calculated by the formulae:

- for  $n$  years

$$\frac{P}{I} = \frac{100}{pn}$$

- for  $d$  days

$$\frac{P}{I} = \frac{36000}{pd}$$

- for  $m$  months

$$\frac{P}{I} = \frac{1200}{pm}$$

## Simple Interest. (Continued)

### Example

How much interest will 750 € earn for 3 years at an annual simple interest rate of  $5\frac{1}{3}\%$ ?

### Proof.

Given  $P = 750$ ,  $p = 5\frac{1}{3} = \frac{16}{3}$ ,  $n = 3$ , we need  $I$ .

By the formula for calculating simple interest on yearly bases,

$$I = \frac{Ppn}{100} = \frac{750 \cdot \frac{16}{3} \cdot 3}{100} = 120.$$



## Simple Interest. (Continued)

### Example

Which principal will earn 15,750 € for 9 months at an annual interest rate of 7%?

### Proof.

We have  $p = 7$ ,  $I = 15,750$ ,  $m = 9$ ;  $P$  is needed.

By the formula for calculating simple interest on monthly bases,

$$P = \frac{100I}{p} \cdot \frac{12}{m} = \frac{100 \cdot 15,750}{7} \cdot \frac{12}{9} = 300,000.$$



## Simple Interest. (Continued)

### Example

If 6,000 € are invested in a bank on April 24 at an annual rate of 7%, how much interest will be earned until October 29 of the same year?

### Proof.

We have  $P = 6,000$ ,  $p = 7$ ,  $d = 30 \cdot 6 + 5 = 185$ ; we need  $I$ .  
By the formula for calculating simple interest on daily bases,

$$I = \frac{Pp}{100} \frac{d}{360} = \frac{7 \cdot 6,000}{100} \frac{185}{360} \approx 215.83.$$



## Simple Interest. (Continued)

### Example

At what annual interest rate,  
7,125 € will earn an interest of 152 € for 96 days?

### Proof.

Given  $P = 7,125$ ,  $d = 96$ ,  $I = 152$ ,  $p$  is required.

We have,

$$p = \frac{100I}{P} \cdot \frac{360}{d} = \frac{100 \cdot 152}{7,125} \cdot \frac{360}{96} = 8.$$

Thus, the annual simple interest rate is 8%. □

## For Further Reading

- <http://fberisha.netfirms.com>
- **Homework:** Exercises from teaching materials
- D. P. Maki, M. Thompson, *Finite mathematics*, pp. 411-421.
- S. T. Karris, *Mathematics for business, science and technology*, pp. 7-1-7-84.
- F. M. Berisha, M. Q. Berisha, *Matematikë – për biznes dhe ekonomiks*, pp. 65-72.

# Summary

- A proportion and solving it
- A percentage and calculating it
- Calculating simple interest
  - on yearly bases,
  - on monthly bases,
  - on daily bases