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Time Value of Money
Basic formulas:

1) Future value

$$FV = PV\,(1 + r)^n$$

2) Fisher effect

$$Rr = \frac{Rn - Ri}{1 + Ri}$$

Rr – Real rate, **Ri** – inflation,
Rn – nominal rate

3) Effective rate

$$r_{ef.} = (1+ r/m)^m - 1$$

m – number of interest periods per year

4) Annuity

$$PV = X \frac{(1 + r)^n - 1}{r(1 + r)^n}$$

$$FV = X \frac{(1 + r)^n - 1}{r}$$

Future Value – FV
Present Value - PV

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Exercise1

The average wage in 1997 in a company was $ 1,010. In the following year the average wage was $ 1,085.75.
Assuming that during the period average inflation was 3.5 percent, calculate the real increase of salary in company (real wage).

Exercise 2

The two banks A and B offer deposit 10%. Bank A uses the annual capitalization of interest and the bank B quarterly. Calculate how much after 5 years will total 100 zł invested in each of the banks. In both cases, calculate an effective rate.

Exercise 3

20 000 PLN was invested in a commercial bank for a period of four years. Interest rate per year is 12%.
a) Please determine the future value in two options: (i) 4 number of interest periods per year (ii) 12 number of interest periods per year
b) Assuming that during the period of time the average inflation rate was 0.4% (at a nominal interest rate of 12%), give the value of the real rate.

Exercise 4

The investor wants to receive 100 000 PLN after 4 years investing in bank.
The two banks A and B offer interest rate of 8%. In Bank A we have 1 number of interest periods per year (m=1) and in Bank B 4 (m=4).
Calculate how much you should invest in each of the banks?

Exercise 5

Assuming that you have an opportunity to invest 1000 PLN (interest rate 16%), please calculate the value of an investment after 5 years (future value):
a) one compounding period per year
b) compounded quarterly
c) Continuously Compounded Interest **(Homework)**

Exercise 6
The effective annual interest rate on deposits is 32.25% . What is the annual nominal rate? Compounded half yearly.

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Exercise 7

Company "A" is planning to purchase new production equipment. Due to the high price of product (100,000 PLN) there is taken into account the option of spreading payments over several years.
The supplier suggested the following options:
a) payment at the time of the purchase (100,000 PLN)
b) payment after 3 years (155,000 PLN)
c) payment in three installments, payable at the end of each year - each installment payable in the amount of 45,000 PLN
Which payment option is most beneficial if we assume 11% discount rate?

Exercise 8

Suppose you deposit each quarter 100 PLN in an investment bank that pays 8% interest per year (compounded quarterly). Calculate the future value of cash flow after 3 year of investment.

Exercise 9

Please make regular payments at the end of each quarter, so that after three years to accumulate the sum of 1,000 PLN. Deposit interest rate is 16%, m = 4. Calculate the amount of the quarterly payment (X).

Exercise 10

Mr. Kowalski is going to invest 5,000 PLN at the end of each next five years. Average annual yield to maturity is 15%. What will be the residual value of an investment (value after 5 years)?

Exercise 11

A young artist is going to apply for a scholarship. Foundation suggest two options:
1. Receipt for the next five years the amount of 2,000 PLN each year, and after six years one-off payment 10 000 PLN;
2. Receipt after one year 9,000 PLN and for the next five years paying an annual scholarship in the amount of 1,800 PLN.
Which option is better for an artist. Assumption: fixed rate 10% per year.