

Discussed questions below from Exam 2015:

1. (a) Suppose that you plan to buy a boat for €10,000 in three years. Given a simple interest rate of 4% per annum on a savings account, how much capital do you need to invest today in order to buy the boat in three years time ?
 - (b) You take a €20,000 loan from a car vendor with a 12% per annum interest rate compounded monthly. You will have to make a fixed monthly repayment over 36 months starting the day of the car purchase. How much is the correct monthly repayment for this loan ?
 - (c) *Benefit Life* offers an ordinary annuity that earns 6.5% interest compounded annually. A person plans to make equal annual deposits into this account for 25 years and then make 20 equal annual withdrawals of €25,000, reducing the balance of the account to zero.
 - (i) Using the *Present value formula* compute the value of the fund based on the withdrawals required.
 - (ii) Using the *Future value formula* compute the amount of each deposit needed in order to maintain the fund.
 - (iii) Compute the total interest earned over the entire 45 years.
2. (a) Consider the matrices

$$A = \begin{pmatrix} 2 & 3 & 2 \\ 4 & 4 & 3 \\ 3 & 4 & 6 \end{pmatrix}, \quad B = \begin{pmatrix} -12 & 10 & -1 \\ 15 & -6 & -2 \\ -4 & -1 & 4 \end{pmatrix}.$$

Calculate the product $A \cdot B$.

- (b) A small dairy produces three cheeses: mild, standard and mature. The following table summarizes the amount of energy, milk and labour used to produce one box of each of the three cheeses together with the amount of these resources available per day.

Resource	Mild A	Standard B	Mature C	Daily available
Energy	2 kWh	3 kWh	2 kWh	100 kWh
Milk	4 L	4 L	3 L	150 L
Labour	3 h	4 h	6 h	170 h

- (i) Let x, y, z be the number of boxes of mild, standard and mature cheese produced daily. Write down a system of three linear equations which hold precisely when all three resources are fully used.
- (ii) Find the values of x, y, z which ensure that all resources are fully used.

Answers:

Q1 (a) € 8,928.52
 (b) € 664.29
 (c) (i) € 275,462.68
 (ii) € 4,677.76
 (iii) € 383,056

Q2 (b)(ii)

$$x = 10, y = 20, z = 10$$