

Course paper 1 - EBA2911¹ Mathematics for Business Analytics

4 – 11 March 2022

The problem set has 2 pages. All 25 subproblems have equal weight. To pass, 60% score is required.

You are required to give reasons for all answers.

Your answers should be provided digitally, as a .pdf file. Write by hand with recognisable handwriting.

Check that the file is easy to read, pencil writing can result in weak files. For more information, see:

<https://portal.bi.no/en/examination/digital-examination/>

Let a be a parameter (an arbitrary number).

Problem 1

Solve the equations for x .

a) $5 \ln(x) - a = 0$ b) $\frac{1}{3}e^x - a + 1 = 0$ c) $\frac{a}{x-3} - 5a + 2 = 0$ d) $ax^4 + 1 = 0$

Problem 2

Solve the inequalities for x .

a) $\frac{1}{5} \ln(x - a) \leq 1$ b) $ax + x \geq 1$ c) $\frac{x-a}{x-3} + 2 \geq 0$ d) $e^{x-a} \leq a$

Problem 3

Kåre is considering an investment proposition given by the cash flow

Year	0	2	8	9	10
Payment	-60	-60	80	80	80

Suppose the discount rate is 15%.

- Calculate the present value of the cash flow.
- Calculate the future value of the cash flow after 7 years.
- For the investment to have 15% as internal rate of return Kåre suggests an extra payment after 7 years. Determine this payment.

Problem 4

- Determine the present value of a payment of 60 million 7 years from now when the annual interest is 9%.
- Give an interpretation of the answer in (a).
- Suppose 60 million is paid after 6 years. Let r be the interest which gives the same present value as in (a). Compute r .
- Explain why the answer in (b) can be written as $r = 1,09^{\frac{7}{6}} - 1$.

Problem 5

Determine a third degree polynomial $f(x)$ with three roots (zeros): $x = -2$, $x = 2 - \sqrt{5}$ and $x = 2 + \sqrt{5}$ and which has constant term 4.

¹Exam code EBA29101

Problem 6

Determine the values of a such that the equation $x^2 + 2ax + 5 = 0$ has solutions.

Problem 7

The remainder of the polynomial division $(x^2 - 6x + 13) : (x - a)$ is 5. Determine a .

Problem 8

Use one parameter to write an expression for all third degree polynomials on the form $x^3 + ax^2 + bx + c$ which have three zeros with the middle one of distance 1 to each of the other two.

Problem 9

- a) Determine the expression of the hyperbola function $f(x)$ which has a vertical asymptote $x = 6$, horizontal asymptote $y = 10,5$ and $f(7) = 10$.
- b) Determine the equation of the ellipse E which has vertical symmetry line $x = 5$, horizontal symmetry line $y = 4$ and the points $(9, 4)$ and $(5, 7)$ are contained in E .

Problem 10

We have a second degree polynomial function $f(x)$ with $f(7) = 10$, $f(17) = 10$ and maximum value $y = 15$.

- a) Calculate $f(9)$.
- b) Determine the zeros of $f(x)$.

Problem 11

Determine the inverse function $g(x)$. Also determine the domain of definition D_g and the range R_g .

- a) $f(x) = -\frac{x}{3} + 7$ with domain of definition $D_f = [0, 21]$.
- b) $f(x) = \ln(x + 2) - 5$ with domain of definition $D_f = \langle -2, \infty \rangle$.