EBA 29101
Mathematics for Business Analytics

Department of Economics

Start date:	05.03.2021	Time 09.00
Finish date:	12.03.2021	Time 12.00

Weight:	Pass / Fail
Total no. of pages:	3 incl. front page
No. of attachments files to question paper:	0
To be answered:	Individually

Answer paper size:	No limit. excl. attachments
Max no. of answer paper attachment files:	0
Allowed answer paper file types:	pdf
Re-sit	Ordinary

Term paper - EBA2911[1] Mathematics for Business Analytics

5 March – 12 March 2021

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. You are encouraged to write with a pen (almost always the best) and scan your paper. Check that the resulting file is easy to read, pencil writing can result in weak scans. For more information, see:
https://portal.bi.no/en/examination/digital-examination/digital-submission/

Problem 1

a) Calculate the sum

$$5\,000 \cdot 1.002^{60} + 5\,000 \cdot 1.002^{59} + 5\,000 \cdot 1.002^{58} + \cdots + 5\,000 \cdot 1.002$$

Describe a financial situation where the sum is used.

b) Calculate the sum

$$\frac{5\,000}{e^{0.002}} + \frac{5\,000}{e^{0.004}} + \frac{5\,000}{e^{0.006}} + \cdots + \frac{5\,000}{e^{0.12}}$$

Describe a financial situation where the sum is used.

Problem 2

We have the cash flow

Year	0	1	2	8
Payment	−18	−25	−15	95

Suppose the discount rate is 12%.

a) Calculate the present value of the cash flow.

b) Calculate the future value of the cash flow after 7 years.

c) Suggest an extra payment after 7 years such that the internal rate of return of the cash flow becomes 12%.

Problem 3

a) Suppose 30 million is paid after 7 years. Let r be the interest which gives 15 million as the present value of the payment (with continuous compounding). Calculate r.

b) Suppose instead that the 30 million is paid after 10 years. Explain why the interest R which gives 15 million as the present value of the payment (with continuous compounding) is given as $R = 0.7 \cdot r$.

Problem 4

Solve the equations.

a) $\sqrt{2x+3} = x - 6$

b) $e^2(\ln(x) - 3)(x^2 - 400)(e^x + 3) = 0$

c) $\dfrac{\ln(x)}{\ln(x) - 10} = 11$

d) $x^{-6} - 6x^{-3} = 16$

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Problem 5

a) Determine the values of t such that the equation $\frac{e^x}{e^x+1} = t$ has solutions for x.

b) Solve the equation for x with these values of t.

Problem 6

Solve the inequalities.

a) $\dfrac{2x - x^2}{x - 5} \leqslant 0$

b) $\dfrac{x - 9}{(x + 3)(x - 4)} \leqslant 1$

c) $\ln(5x + 20) \leqslant 3$

d) $e^{0.3x} \leqslant 170 e^{-0.1x}$

e) $(4 - x^2) \cdot e^x \cdot \ln(5 - x) \geqslant 0$

Problem 7

We have $f(x) = 3x^3 - 7x^2 - 10x + 14$ and $g(x) = (x - 1)(x - 3)$.

a) Calculate the remainder of the polynomial division $f(x) : g(x)$.

b) Determine the asymptotes of the rational function $\dfrac{f(x)}{g(x)}$.

Problem 8

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

a) $f(x) = -0.2x + 20$ with domain of definition $D_f = [0, 10]$.

b) $f(x) = e^{-0.1x} + 3$ with domain of definition $D_f = [0, \rightarrow)$.

Problem 9

Write the expression for all second degree polynomial functions $f(x)$ with maximum point $x = 70$ and maximal value $y = 200$.

Problem 10

We have a hyperbola function $f(x)$ with vertical asymptote $x = 9$ and horizontal asymptote $y = 11$. Moreover, $f(4) = 12$. Determine where the graph of $f(x)$ intersects the x-axis and where it intersects the y-axis.

Problem 11

The ellipse E has centre $(5, 6)$, horizontal semi-axis 3 and vertical semi-axis 4. The line L goes through the points $(0, 10)$ og $(10, 0)$. Determine where E and L intersects.