EBA 2911, extra lecture B, 23 Nov. 2020, Runar Ile

Plan
1. About the exam (technical)
2. How to prepare.
3. Multiple choice spring 2019

1. About the exam

- 12 problems
- 3 hours, but this includes scanning and uploading. 2,5 hours: 12,5 min/problem
- Ordinary questions. Must give reasons.
- Advice: Make a pdf after 2,5 hours. (if more time: check your answers!)
- Practice "scann/merge/compress/upload"-procedure!
- Write by hand! (one problem a page)
- Better to submit 9 problems on time than 12 problems too late.
- External grader + me
- The problems are not ordered as the curriculum.
- The first problems should be central and somewhat basic.
- The exam counts for 20% of final grade

2. How to prepare

1) what is the relevant material?
   - lecture notes
   - tutoring problems
   - earlier multiple choice exams

2) Try to "solve" the problems in your head. (no writing!)
   - what is the plan (in detail)
   - what kind of knowledge is required?
   - what kind of obstacles may occur?

3) If you get a wrong answer:
   - what went wrong? - the plan or the execution

4) When you have solved a problem
   - what did you learn?

5) Learn the basics well!
   - definitions, concepts

6) The basic problems are the most important ones!

Ex: $e^x = 5$ or $\ln(x+5) = 0$

Start at 13^{50}

3. Multiple choice exam, spring 2019

Prob 1 Present value $K_0 = \dfrac{K_n}{(1+r)^n}$

Prob 2 A: $f'(x) \overset{\text{product rule}}{=} 2x \cdot e^x + x^2 \cdot e^x$

Answer: $x(x+2)e^x = (x^2+2x)e^x$

$= x^2 \cdot e^x + 2x \cdot e^x$ → ok

B: $f'(x) \overset{\text{quot. r.}}{=} \dfrac{\frac{1}{x} \cdot x^2 - \ln(x) \cdot 2x}{(x^2)^2}$

$= \dfrac{x - \ln(x) \cdot 2x}{x^4} = \dfrac{\cancel{x}(1 - 2\ln(x))}{x^{\cancel{4}\,3}}$ → ok

C: $f'(x) \overset{\text{chain r.}}{=} \dfrac{1}{\cancel{2}\sqrt{x^2+1}} \cdot \cancel{2}x = \dfrac{x}{\sqrt{x^2+1}}$ → ok.

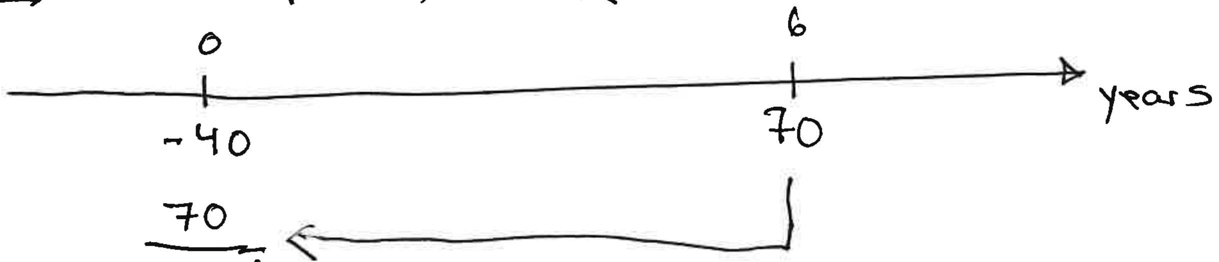
$u = x^2+1$ and $g(u) = \sqrt{u} = u^{\frac{1}{2}}$

$u' = 2x$ $\qquad g'(u) = \frac{1}{2} u^{-\frac{1}{2}} = \dfrac{1}{2\sqrt{x^2+1}}$

D: Use the quot. rule (the sign...) – wrong.

Prob 3 $f(x) = e^{-x} = \dfrac{1}{e^x}$ + knowledge

Prob 4 Cash flow, IRR $= r$



$\dfrac{70}{(1+r)^6}$

$\underline{\qquad\qquad}$

$= 0$

Eq: $-40 + \dfrac{70}{(1+r)^6} = 0$ & solve

$r = \left(\frac{7}{4}\right)^{\frac{1}{6}} - 1$

Problem 5 Solution 1: Look at the asymptotes!

$x = 10$ (vertical)

$y = 4$ (horizontal) } the only green.

to find $y=4$ we can use l'Hôpital:

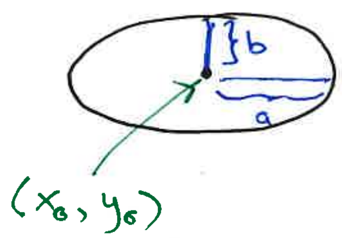
$$\lim_{x\to\infty} \frac{4x-38}{x-10} \overset{\text{l'Hop.}}{=} \lim_{x\to\infty} \frac{4}{1} = 4$$

Solution 2: Insert some number into $f(x)$ (like $x=5$):

$$f(5) = \frac{4\cdot 5-38}{5-10} = \frac{-18}{-5} = \underline{3.6}$$

Problem 6 Std. form for the ellipse equation:

$$\frac{(x-x_0)^2}{a^2} + \frac{(y-y_0)^2}{b^2} = 1$$



Prob 7 Either square each side of

$$x - 22 = 9\sqrt{x}$$

or substitute $u = \sqrt{x}$ so $u^2 = x$ to get

$$u^2 - 9u - 22 = 0$$

$$u = \frac{9 \pm \sqrt{9^2 - 4\cdot 1\cdot(-22)}}{2} = \frac{9 \pm 13}{2}$$

But $u \geq 0$ so only $u = \frac{9+13}{2} = 11$ & $x = 11^2 = 121$.

→ only one solution.

Problem 7

The equation $x - 9\sqrt{x} - 22 = 0$ has

(A) no solutions
(B) a solution
(C) two solutions
(D) three solutions
(E) I choose not to answer this problem.

Problem 8

Which statement is true?

(A) $1{,}1^{15} > 1{,}05^{30}$
(B) $1{,}04^{300\,000} < 1{,}12^{100\,000}$
(C) $e^{12\,000} < 1{,}12^{100\,000}$
(D) $e^{12\,000} > 1{,}04^{300\,000}$
(E) I choose not to answer this problem.

12 % nominal interest, different compounding

Problem 9

The inequality $\dfrac{(x-1)(12-3x)}{(x-2)} \leqslant 0$ has the solutions

– sign diagram!

(A) x is an element in $[1, 4]$
(B) x is an element in $\langle -\infty, 1] \cup [4, \infty\rangle$
(C) x is an element in $[1, 2\rangle \cup [4, \infty\rangle$
(D) x is an element in $\langle -\infty, 0] \cup \langle 2, 4]$
(E) I choose not to answer this problem.

Problem 10

A cost function $C(x)$ is supposed to satisfy three conditions:

(1) $C(0) > 0$
(2) $C(x)$ is an increasing function
(3) $C(x)$ is a convex function

differentiation
—— " —— once more

Which of these functions is not a cost function?

(A) $C(x) = 0{,}01x + 1200,\ x \geqslant 0$
(B) $C(x) = 800e^{0{,}1(x-3)},\ x \geqslant 0$
(C) $C(x) = 1000\ln(x^2 + 50),\ x \geqslant 0$
(D) $C(x) = 0{,}005x^2 + 0{,}1x + 900,\ x \geqslant 0$
(E) I choose not to answer this problem.

Problem 11

Let p be the price of a commodity and suppose $D(p) = 100 - 2p$ for $0 < p < 50$ is the demand function. Which statement is true?

(A) If $0 < p < 25$ the demand is elastic
(B) If $p = 20$ the demand is unit elastic
(C) If $25 < p < 50$ the demand is elastic
(D) If $10 < p < 40$ the demand is inelastic
(E) I choose not to answer this problem.

Elastic: $\mathcal{E}(p) = \dfrac{D'(p)\cdot p}{D(p)} < -1$

(also solves inelastic: – opposite inequality and unit elastic: equality)

Problem 12

Which of these functions has no vertical asymptote?

(A) $f(x) = \ln(x)$ $x = 0$

(B) $f(x) = \dfrac{1}{x^2+6x+5}$ $x = -1$, $x = -5$

(C) $f(x) = \dfrac{x-3}{2x+5}$ $x = -2.5$

(D) $f(x) = \dfrac{e^x}{x^2-6x+10}$ defined for all x because $x^2-6x+10 = (x-3)^2+1 \geq 1$

(E) I choose not to answer this problem.

Problem 13

I figure 3 we see the graph of the second derivative $f''(x)$. Which statement is true?

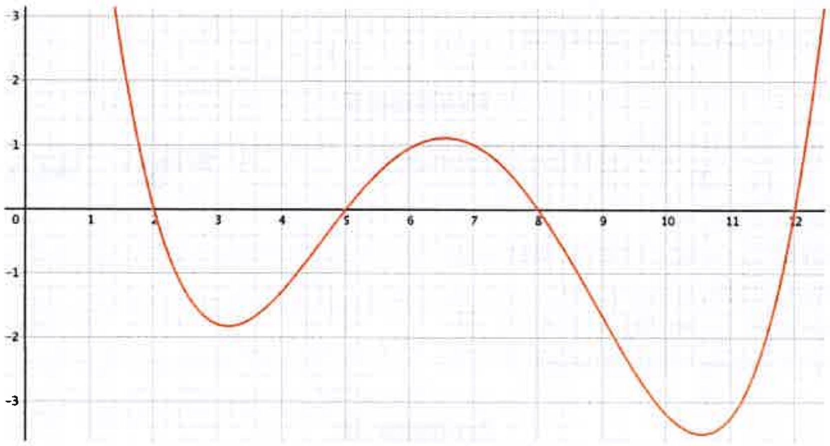


Figure 3: The graph of $f''(x)$

(A) $f(x)$ is concave for x between 5 and 8
(B) $f'(x)$ is concave for x between 7 and 10
(C) $f'(2) < f'(5)$
(D) $f(x)$ has to be decreasing for x between 2 and 3
(E) I choose not to answer this problem.

Problem 14

We want to write all third degree polynomials of the form x^3+bx^2+cx+d which have three zeros, the middle one of the zeros should be 3 more than the smallest and 4 less than the largest. Which of these polynomials is not such a polynomial?

3 4

$r-3$ r $r+4$

(A) $(x-r)(x-r-4)(x-r+3)$ ok
(B) $(x-t)(x-t+3)(x-t+7)$
(C) $(x-k)(x-k-3)(x-k-7)$
(D) $(x-s+1)(x-s-2)(x-s-6)$
(E) I choose not to answer this problem.

3 4

$t-7$ $t-3$ t B

4 3 wrong!

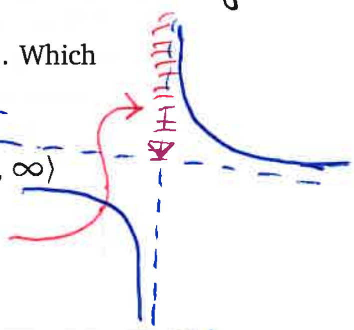
Problem 15

We have the function expression $f(x) = \frac{5x-3}{x-1}$ with domain of definition $D_f = \langle 1, \infty \rangle$. Which statement is true?

hyperbola function

(A) $f(x)$ has no inverse function
(B) $f(x)$ has an inverse function $g(x)$ with domain of definition $D_g = \langle -\infty, 5 \rangle \cup \langle 5, \infty \rangle$
(C) $f(x)$ has an inverse function $g(x)$ with domain of definition $D_g = \langle -\infty, 5 \rangle$
(D) $f(x)$ has an inverse function $g(x)$ with domain of definition $D_g = \langle 5, \infty \rangle = V_f$
(E) I choose not to answer this problem.

$y = 5$



$x = 1$