Multiple Choice 1 MET1180 - Matematikk for siviløkonomer

21 May 2019

ENGLISH TRANSLATION

The problem set has 15 multiple choice problems. Correct answer gives 3 points, incorrect answer gives -1 points, answer (E) gives 0 points. Only one answer is correct.

Problem 1

The present value of 40 million paid 7 years from now with 12% interest and annual compounding is:

(A) Between 20 million and 24 million
(B) 18,09 million
(C) 17,27 million
(D) 35,71 million
(E) I choose not to answer this problem.

Problem 2

Which differentiation is not correct?

(A) If $f(x) = x^2 e^x$ then $f'(x) = x(x+2)e^x$

(B) If $f(x) = \dfrac{\ln(x)}{x^2}$ then $f'(x) = \dfrac{1-2\ln(x)}{x^3}$

(C) If $f(x) = \sqrt{x^2+1}$ then $f'(x) = \dfrac{x}{\sqrt{x^2+1}}$

(D) If $f(x) = \dfrac{x-1}{x+2}$ then $f'(x) = \dfrac{1}{(x+2)^2}$

(E) I choose not to answer this problem.

Problem 3

We have the function $f(x) = e^{-x}$. What is correct?

(A) The inequality $f(x) < 0$ has no solutions
(B) The graph of $f(x)$ does not intersect the y-axis
(C) $f(x)$ is an increasing function
(D) $f(x)$ is not defined when $x = 0$
(E) I choose not to answer this problem.

Problem 4

Suppose 40 million is invested today and 70 million is repaid after 6 years. Then the internal rate of return of the investment (with annual compounding) is

(A) between 9,5% and 9,6%
(B) between 9,6% and 9,7%
(C) between 0,097 and 0,098
(D) between 1,097 and 1,098
(E) I choose not to answer this problem.

Problem 5

We have the hyperbola function $f(x) = \dfrac{4x-38}{x-10}$. Which of the graphs in figure 1 is the graph of $f(x)$?

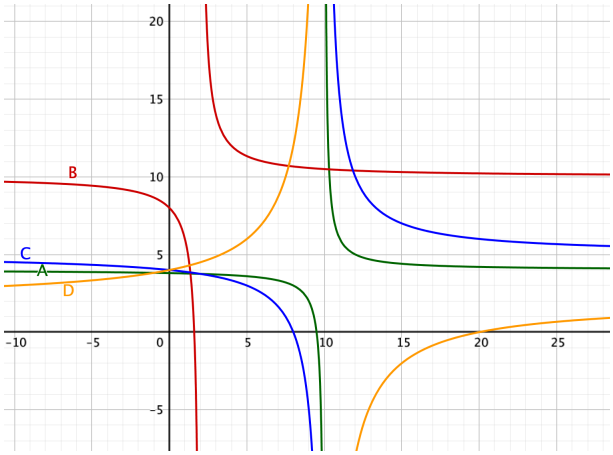

Figure 1: Graphs A-D

(A) $f(x)$ has the graph A (green)
(B) $f(x)$ has the graph B (red)
(C) $f(x)$ has the graph C (blue)
(D) $f(x)$ has the graph D (yellow)
(E) I choose not to answer this problem.

Problem 6

Figure 2 shows an ellipse.

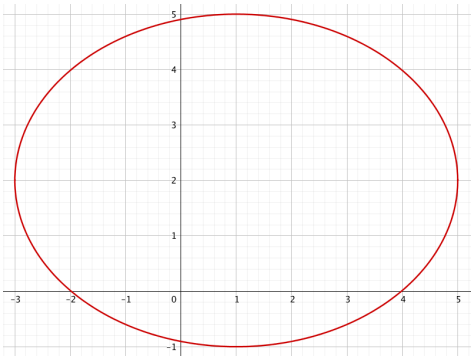

Figure 2: Ellipse

Which equation defines the ellipse?

(A) $9(x-1)^2 + 16(y-2)^2 = 144$
(B) $\frac{(x+1)^2}{16} + \frac{(y+2)^2}{9} = 1$
(C) $\frac{(x-1)^2}{9} + \frac{(y-2)^2}{16} = 1$
(D) $\frac{(x-2)^2}{16} + \frac{(y-1)^2}{9} = 1$
(E) I choose not to answer this problem.

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.

Problem 9

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

(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

Which of these functions is <u>not</u> 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.

Problem 12

Which of these functions has no vertical asymptote?

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

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

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

(D) $f(x) = \dfrac{e^x}{x^2-6x+10}$

(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?

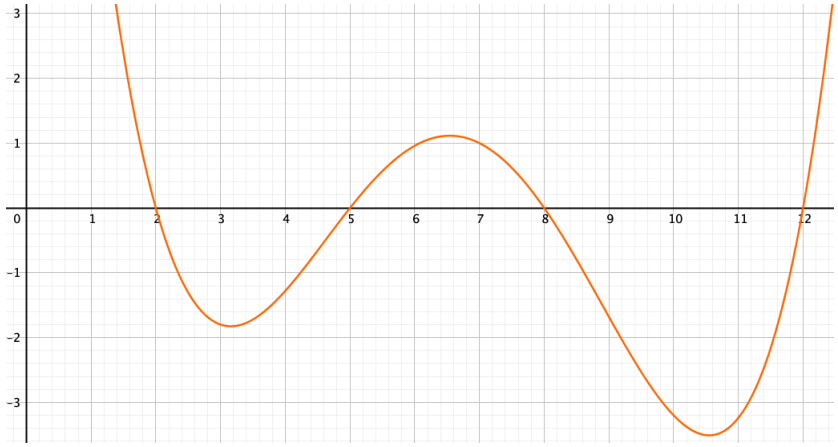

Figure 3: The graph of $f''(x)$

(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?

(A) $(x-r)(x-r-4)(x-r+3)$
(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.

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?

(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 $D_g = \langle 5, \infty \rangle$
(E) I choose not to answer this problem.

Formelsamling

1 Finansmatematikk

Geometriske rekker. En endelig geometrisk rekke har sum

$$S_n = a_1 \cdot \frac{1-k^n}{1-k}$$

og en uendelige geometrisk rekke har sum

$$S = a_1 \cdot \frac{1}{1-k} \quad \text{når } |k| < 1$$

Nåverdier. Nåverdien K_0 til en innbetaling K_n er henholdsvis

$$K_0 = \frac{K_n}{(1+r)^n} \quad \text{og} \quad K_0 = \frac{K_n}{e^{rn}}$$

ved diskret og kontinuerlig diskonteringsrente.

2 Integrasjon

Integrasjonsmetoder.

a) Delvis integrasjon:

$$\int u'v \,\mathrm{d}x = uv - \int uv' \,\mathrm{d}x$$

b) Substitusjon:

$$\int f(u)u' \,\mathrm{d}x = \int f(u) \,\mathrm{d}u$$

c) Delbrøksoppspaltning:

$$\int \frac{px+q}{(x-a)(x-b)} = \int \left(\frac{A}{x-a} + \frac{B}{x-b} \right) \mathrm{d}x$$

Areal. Regionen gitt ved $f(x) \leq y \leq g(x)$ for $a \leq x \leq b$ har areal

$$A = \int_a^b (g(x) - f(x)) \,\mathrm{d}x$$

3 Lineær algebra

Cramers regel. Et lineært system $A\mathbf{x} = \mathbf{b}$ der $|A| \neq 0$ har en entydig løsning gitt ved

$$x_1 = \frac{|A_1(\mathbf{b})|}{|A|} \quad x_2 = \frac{|A_2(\mathbf{b})|}{|A|} \quad \ldots \quad x_n = \frac{|A_n(\mathbf{b})|}{|A|}$$

der $A_i(\mathbf{b})$ er matrisen som framkommer ved å bytte ut kolonne i fra matrisen A med $\mathbf{b}$.

4 Funksjoner i flere variable

Annenderivert-testen. Et stasjonært punkt (x^*, y^*) for funksjonen $f(x, y)$ er et

a) lokalt minimum om $A > 0$ og $AC - B^2 > 0$
b) lokalt maksimum om $A < 0$ og $AC - B^2 > 0$
c) sadelpunkt om $AC - B^2 < 0$

når vi setter $A = f''_{xx}(x^*, y^*)$, $B = f''_{xy}(x^*, y^*)$ og $C = f''_{yy}(x^*, y^*)$.

Nivåkurver. På nivåkurven $f(x, y) = c$ er den deriverte $y' = \mathrm{d}y/\mathrm{d}x$ gitt ved

$$\frac{\mathrm{d}y}{\mathrm{d}x} = -\frac{f'_x}{f'_y}$$

Totalderivasjon. Når $z = f(x, y)$, og vi har $x = x(t)$ og $y = y(t)$, så er den totalderiverte

$$\frac{\mathrm{d}z}{\mathrm{d}t} = \frac{\partial f}{\partial x} \cdot \frac{\mathrm{d}x}{\mathrm{d}t} + \frac{\partial f}{\partial y} \cdot \frac{\mathrm{d}y}{\mathrm{d}t}$$

EKSEMPEL

SVARARK TIL FLERVALGSEKSAMEN

ANSWER SHEET FOR MULTIPLE CHOICE EXAMINATION

Eksamenskode:
Examination code: MET1180 5

Initialer:
Personal initials: NN

ID-nummer: (**SKAL** fylles ut!)
ID-number: (**MUST** be filled in!)

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Skriv tydelig!
Fyll ut med ☒
Annuler kryss med ■
Helt fylt rute blir ikke registrert

Write clearly!
Record answer with ☒
Cancel a cross with ■
Compl. filled boxes will not be registered

Dette svararket leses kun av en maskin. Ikke noe av det du skriver utenom de definerte feltene blir lest eller tatt hensyn til.
Ikke kluss på arket. Be heller om et nytt.

This answer sheet is only read by a machine. Answers or comments written on the examination paper or outside the boxes will not be graded.
Do not scribble on this sheet.
Please ask for a new answer sheet if you need one.

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