Multiple Choice 1 MET1180 - Matematikk for siviløkonomer

12 December 2018

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 remainder of the polynomial division $(3x^2 - 13x + 19) : (x - 2)$ is

(A) 0
(B) 1
(C) 5
(D) 6
(E) I choose not to answer this problem.

Problem 2

We have a function $f(x)$ with the following graph:

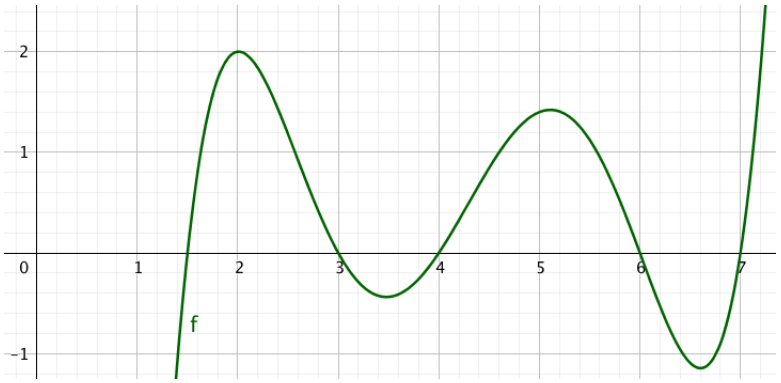

Figure 1: The graph of $f(x)$

Which statement is not correct?

(A) $f(3) = 0$
(B) $f'(3) < 0$
(C) $f'(x)$ changes sign between $x = 4{,}2$ and $x = 5{,}8$
(D) $f'(2) > f'(5)$
(E) I choose not to answer this problem.

Problem 3

The price of a stock has precisely doubled in 12 years. It gives an annual growth factor of

(A) $2^{\frac{1}{12}}$
(B) 7%
(C) 1,07
(D) $\frac{13}{12}$
(E) I choose not to answer this problem.

Problem 4

We have a quadratic function $f(x)$ with minimum in the point $(x, y) = (4, 1)$ and $f(2) = 3$. Then

(A) $f(x) = (x+4)^2 - 1$
(B) $f(x) = (x-4)^2 + 1$
(C) $f(x) = \frac{1}{2}x^2 - 4x + 9$
(D) $f(x) = -\frac{1}{2}(x-4)^2 + 1$
(E) I choose not to answer this problem.

Problem 5

A fixed amount 90 000 (the annuity) is to be payed annually for 20 years with the first payment three years from now. Suppose the interest is 4% with annual compounding. Then the geometric series which gives the present value of this cash flow is

(A) $$\frac{90\,000}{1{,}04^3} + \frac{90\,000}{1{,}04^4} + \cdots + \frac{90\,000}{1{,}04^{22}} + \frac{90\,000}{1{,}04^{23}}$$

(B) $$\frac{90\,000}{1{,}04^3} + \frac{90\,000}{1{,}04^4} + \cdots + \frac{90\,000}{1{,}04^{21}} + \frac{90\,000}{1{,}04^{22}}$$

(C) $$\frac{90\,000}{1{,}04} + \frac{90\,000}{1{,}04^2} + \cdots + \frac{90\,000}{1{,}04^{19}} + \frac{90\,000}{1{,}04^{20}}$$

(D) $$90\,000 + 90\,000 \cdot 1{,}04 + \cdots + 90\,000 \cdot 1{,}04^{18} + 90\,000 \cdot 1{,}04^{19}$$

(E) I choose not to answer this problem.

Problem 6

The equation $\sqrt{2x+3} = x + 4$ has

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

Problem 7

Hege deposits 300 000 into an account earning 2,4% interest and with continuous compounding. How long time will it take before the balance is 500 000?

(A) $\dfrac{\ln 5 - \ln 3}{0{,}024}$ years

(B) 23 years

(C) $\dfrac{\ln 5 - \ln 3}{\ln(1{,}024)}$ years

(D) 27,78 years

(E) I choose not to answer this problem.

Problem 8

We have a cost function $K(x) = 0{,}01x^2 + 15x + 1600$. Then the minimal average unit cost is

(A) 400
(B) 23
(C) 40
(D) 9200
(E) I choose not to answer this problem.

Problem 9

We have the function $f(x) = 3\ln(x) - 0{,}5x + 10$, $x > 0$. Which statement is not correct?

(A) $f(x)$ is increasing in the interval $\langle 0, 4]$
(B) $f'(x)$ is negative in the interval $\langle 7, \infty \rangle$
(C) $f(x)$ has a global maximum point for $x = 6$
(D) $f''(3) = \frac{1}{3}$
(E) I choose not to answer this problem.

Problem 10

Let p be the price of a commodity and suppose $D(p) = 75e^{-0{,}2p}$ is the demand function. Which statement is correct?

(A) If $p < 10$ the demand is inelastic
(B) If $p < 5$ the demand is elastic
(C) If $p > 5$ the demand is elastic
(D) If $p = 10$ the demand is unit elastic
(E) I choose not to answer this problem.

Problem 11

We have

$$a = \lim_{x \to 1} \frac{e^x - e}{x - \sqrt{x}}$$

Which statement is correct?

(A) $a = 3e$

(B) $a = 2e$

(C) $a = \dfrac{e}{2}$

(D) $a = \dfrac{2}{e}$

(E) I choose not to answer this problem.

Problem 12

We have a function $f(x)$ with derivative function $f'(x)$ which has the following graph:

Figure 2: The graph of $f'(x)$

Which statement is correct?

(A) $f(x)$ is concave in the interval $[5-\frac{1}{\sqrt{3}}, 5+\frac{1}{\sqrt{3}}]$
(B) $f(x)$ is convex in the interval $[7, 8]$
(C) $f(x)$ is concave
(D) $f(x)$ is convex in the interval $[1, 5]$
(E) I choose not to answer this problem.

Problem 13

Suppose $P_2(x)$ is the degree 2 Taylor polynomial of $f(x) = \ln(x)$ in the point $x = 1$.
Which statement is correct?

(A) The distance from $P_2(2)$ to $f(2)$ is more than 0,3
(B) The distance from $P_2(2)$ to $f(2)$ is between 0,2 and 0,3
(C) The distance from $P_2(2)$ to $f(2)$ is between 0,1 and 0,2
(D) The distance from $P_2(2)$ to $f(2)$ is between 0 and 0,1
(E) I choose not to answer this problem.

Problem 14

We have a curve implicitly defined by the equation $4x^2 - 7xy + 4y^2 = 16$.
Which statement is correct?

(A) There is only one point on the curve with x-coordinate 4 and the slope of the tangent at this point is equal to -1
(B) There are two points on the curve with x-coordinate 4 and the product of the slopes of the tangents at these points is $-2{,}75$
(C) There are two points on the curve with x-coordinate 4 and the product of the slopes of the tangents at these points is -64
(D) There are two points on the curve with x-coordinate 4 and the product of the slopes of the tangents at these points is $\frac{1024}{425}$
(E) I choose not to answer this problem.

Problem 15

We have the function expression $f(x) = x^3 - 6x^2 + 9x + 4$.
Which statement is correct?

(A) If the domain of definition D_f is $[4, \infty\rangle$ then $f(x)$ has an inverse function.
(B) If the domain of definition D_f is $[3, \infty\rangle$ then $f(x)$ has no inverse function.
(C) If the domain of definition D_f is $[0, 3]$ then $f(x)$ has an inverse function.
(D) If the domain of definition D_f is $\langle -\infty, 1]$ then $f(x)$ has no inverse function.
(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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