+1/1/60+

EPFL

1

Teacher : TEACHER NAME
EXAM NAME - MAN
DATE
Duration : XXX minutes

Student One

SCIPER : **111111**

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ce qu'il ne faut **PAS** faire | what should **NOT** be done | was man **NICHT** tun sollte		

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First part: multiple choice questions

For each question, mark the box corresponding to the correct answer. Each question has **exactly one** correct answer.

Question 1 Let the subset $E \subset \mathbb{R}$ defined by $E = \left\{ 2\left(1+\frac{1}{n}\right)^n : n \in \mathbb{N} \setminus \{0\} \right\}$.

Then

- [x] 10 is a majorant of E
- [ ] the minimum of E is 2
- [ ] E is closed
- [x] 10 is a majorant of E
- [ ] the supremum of E belongs to E

Question 2 The equation $z^{-1} = \overline{z}$, where $\overline{z}$ is the complex conjugate of z, has

- [x] an infinity of solutions in $\mathbb{C}$
- [ ] exactly one solution in $\mathbb{C}$
- [ ] no solution in $\mathbb{C}$
- [ ] exactly two solutions in$\mathbb{C}$

Question 3 Let the subset $E \subset \mathbb{R}$ defined by $E = \left\{ 2\left(1+\frac{1}{n}\right)^n : n \in \mathbb{N} \setminus \{0\} \right\}$.

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Second part: true/false questions

For each question, mark the box (without erasing) TRUE if the statement is **always true** and the box FALSE if it is **not always true** (i.e., it is sometimes false).

Question 4 Let $f\colon \mathbb{R} \to \mathbb{R}$ and $g\colon \mathbb{R} \to \mathbb{R}$ are two functions defined on all $\mathbb{R}$. If $f \circ g$ is injective, then g is injective.

■ VRAI ☐ FAUX

Question 5 Let A be a bounded and non empty subset of $\mathbb{R}$.
Then $\inf A \in A$ and $\sup A \in A$.

☐ VRAI ■ FAUX

Third part, open questions

Answer in the empty space below. Your answer should be carefully justified, and all the steps of your argument should be discussed in details. Leave the check-boxes empty, they are used for the grading.

Question 5: *This question is worth 6 points.*

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ■6

Let $\alpha \in \mathbb{C}$.

1. Find the explicit formula for the elements of the matrix $A_n = \begin{pmatrix} \alpha & 1 \\ 0 & \alpha \end{pmatrix}^n$, where $n \geq 1$ is an integer. Show the formula by reccurance.
2. Let $\alpha = 1 + \mathrm{i}$. Calculate α^{99} and α^{100}.
3. Calculate $\begin{pmatrix} 1+\mathrm{i} & 1 \\ 0 & 1+\mathrm{i} \end{pmatrix}^{100}$.

Question 6: *This question is worth 10 points.*

0 .5 1 .5 2 .5 3 .5 4 .5 5
.5 6 .5 7 .5 8 .5 9 .5 10

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Question 7: *This question is worth 20 points.*

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EPFL

2

Teacher : TEACHER NAME
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Student Two

SCIPER : **222222**

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First part: multiple choice questions

For each question, mark the box corresponding to the correct answer. Each question has **exactly one** correct answer.

Question 1 The equation $z^{-1} = \overline{z}$, where $\overline{z}$ is the complex conjugate of z, has

- ☐ exactly two solutions in$\mathbb{C}$
- ☐ no solution in $\mathbb{C}$
- ☐ exactly one solution in $\mathbb{C}$
- ■ an infinity of solutions in $\mathbb{C}$

Question 2 Let the subset $E \subset \mathbb{R}$ defined by $E = \left\{ 2\left(1+\frac{1}{n}\right)^n : n \in \mathbb{N} \setminus \{0\} \right\}$.

Then

- ☐ the supremum of E belongs to E
- ■ 10 is a majorant of E
- ■ 10 is a majorant of E
- ☐ E is closed
- ☐ the minimum of E is 2

Question 3 Let the subset $E \subset \mathbb{R}$ defined by $E = \left\{ 2\left(1+\frac{1}{n}\right)^n : n \in \mathbb{N} \setminus \{0\} \right\}$.

Then

- ☐ E is closed
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Second part: true/false questions

For each question, mark the box (without erasing) TRUE if the statement is **always true** and the box FALSE if it is **not always true** (i.e., it is sometimes false).

Question 4 Let A be a bounded and non empty subset of $\mathbb{R}$.
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☐ VRAI ■ FAUX

Question 5 Let $f\colon \mathbb{R} \to \mathbb{R}$ and $g\colon \mathbb{R} \to \mathbb{R}$ are two functions defined on all $\mathbb{R}$. If $f \circ g$ is injective, then g is injective.

■ VRAI ☐ FAUX

Third part, open questions

Answer in the empty space below. Your answer should be carefully justified, and all the steps of your argument should be discussed in details. Leave the check-boxes empty, they are used for the grading.

Question 5: *This question is worth 6 points.*

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ■6

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0 .5 1 .5 2 .5 3 .5 4 .5 5
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0 1 2 3 4 5 6 7 8 9 10
11 12 13 14 15 16 17 18 19 20

Let $\alpha \in \mathbb{C}$.

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EPFL

3

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Student Three

SCIPER : **333333**

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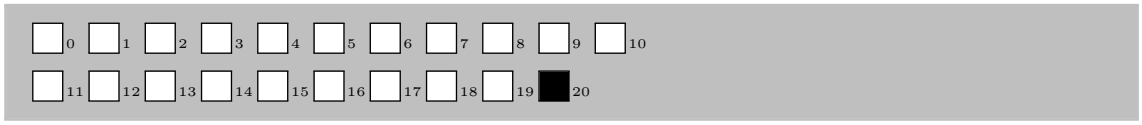

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EPFL

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4

Student Four

SCIPER : **444444**

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