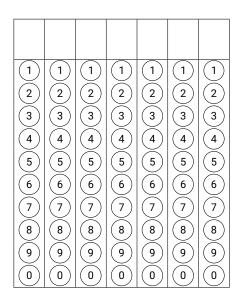
### **Questions**

1	2	3	4	5

### Surname, First name

#### Intro to Math 19/20

Introduction to Mathematics - Sample Test 1 6 September 2019 09:00 - 12:00



There are three types of questions: "final answer", "open answer" and "multiple choice".

### · Final answer

In the text frame below the question, you only provide \*one\* answer. Do not write down a calculation, explanation or motivation. If you do write down a calculation, explanation or motivation, it will not be taken into account for grading.

### · Open answer

You provide a calculation or motivation in the text frame below the question. The calculation or motivation will be graded. Any text outside the frame will be ignored.

#### Multiple choice

Only one answer is correct. Choose the correct answer by marking it with a black or blue pen or pencil.

### · Multiple response

More than one answer may be correct. Choose the correct answer(s) by marking them with a black or blue pen or pencil.

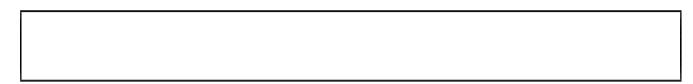
Before you enter a solution into a text frame, elaborate the answer on scratch paper. Do not submit scrap paper.

# **Exercise 1: Sets**

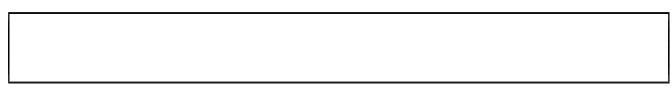
Let  $A=\{rac{k}{k+1}\,|\,k\in\mathbb{N}\}$ . For each of the following, either write 'does not exist or give its value.

Provide the answer (and only the answer) in the frames below.

0.5p **1a**  $\inf A =$ 

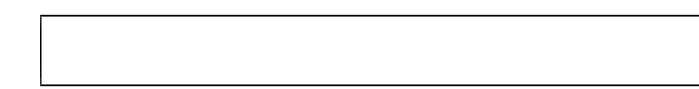


0.5p  $\mathbf{1b} \quad \max A =$ 



0.5p **1c**  $\min A =$ 

0.5p **1d**  $\sup A =$ 



## **Exercise 2: Predicate logic**

For each of the following predicates, determine whether it is a tautology, a contradiction or neither.

These are multiple choice questions; per question, only one answer is correct.

Grading:

4 correct answers: 2 pt 3 correct answers: 1 pt

2 or less correct answers: 0 pt

The amount of points stated in the margin is the maximum amount of points that can be scored for that question.

- 0.5p **2a**  $p \wedge p$ 
  - tautology

neither

contradiction

0.5p **2b**  $p \wedge \neg p$ 

0

tautology

neither

contradiction

0

0.5p **2c**  $p \lor \neg p$ 

tautology

contradiction

- neither
- 0.5p **2d**  $p \rightarrow \neg p$

0

tautology

neither

contradiction

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# Exercise 3: Even and odd

Let  $m \in \mathbb{Z}$  and  $n \in \mathbb{Z}$ . Prove that if the product mn is even, then either m is even, or n is even (or both). Зр 3 Give a full calculation/motivation for your answer in the frame below.





# **Exercise 4: Mathematical induction**

3p **4** Use mathematical induction on n to prove that  $\forall n \in \mathbb{N} \cup \{0\}$ :

$$\sum_{i=0}^{n} \binom{i+2}{i} = \binom{n+3}{n}.$$

Hint: use that  $\binom{n+1}{r}=\binom{n}{r-1}+\binom{n}{r}$  for all  $n\in\mathbb{N}$ ,  $r\in\mathbb{N}$ ,  $r\leqslant n$ .

Give a full calculation/motivation for your answer in the frame below.





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# **Exercise 5: Combinatorics**

Consider the set A of numbers consisting of 4 digits, where each digit is from the set  $\{1,2,3\}$ . For example:  $1311 \in A$ .

For each question, give a full calculation/motivation for your answer in the frame below the question.

5a How many odd numbers are there in A?



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2p

**5b** How many numbers in A are either odd, or start with the digit 1, or both?