

## Unit 1 – Introduction to the course

### I Getting to know each other and university studies

#### 1. Find out information about your classmates, pay attention to the correct form of questions:

Find someone who ...

... prefers oral exams to written exams.

... went skiing during the examination period.

... is studying applied mathematics.

... is going to do homework tonight.

... has been to the library this week.

... will have to study hard this semester.

You can practice making questions online, e.g. [https://www.englisch-hilfen.de/en/exercises\\_list/fragen.htm](https://www.englisch-hilfen.de/en/exercises_list/fragen.htm)

#### 2. Can you add more vocabulary related to your studies? Sort out the following nouns into groups and think about appropriate verbs which go with the nouns:

assignment	lecture	tutorial	examination	assessment	research
library	dormitory	professor	supervisor	degree	Master
Bachelor	dean	scholarship	department	fieldwork	graduate

#### 3. Complete these questions with the most appropriate words (adapted from Agnieszka Suchomelová-Polomska):

- How many exams do you usually \_\_\_\_\_ within one week?
- Have you \_\_\_\_\_ all your exams so far?
- How many assignments do you have to \_\_\_\_\_ this term?
- Do you prefer exams or continuous \_\_\_\_\_?
- Do you always \_\_\_\_\_ all your lectures?
- Can good students receive \_\_\_\_\_ at your faculty?

## II Theorems in Mathematics

**1. What is a theorem in mathematics? Which typical vocabulary do mathematicians need when dealing with theorems?**

**2. EXAM PRACTICE. Complete gaps 1 – 8 in the text on theorems with the following words. There are three words that you will not need to use:**

AXIOMS            PROOFS            PRECISE            DEDUCTIVE            ESTABLISHED            FORMAL  
STATEMENT       INTERPRETED       INFORMAL            REASON            CONSEQUENCE

In mathematics, a theorem is a (1)\_\_\_\_\_ that has been proved on the basis of previously (2)\_\_\_\_\_ statements, such as other theorems, and generally accepted statements, such as (3)\_\_\_\_\_. A theorem is a logical (4)\_\_\_\_\_ of the axioms. The proof of a mathematical theorem is a logical argument for the theorem statement given in accord with the rules of a deductive system. The proof of a theorem is often (5)\_\_\_\_\_ as justification of the truth of the theorem statement. In light of the requirement that theorems must be proved, the concept of a theorem is fundamentally (6)\_\_\_\_\_, in contrast to the notion of a scientific law, which is experimental.

To be proved, a theorem must be expressible as a (7)\_\_\_\_\_, formal statement. Nevertheless, theorems are usually expressed in natural language rather than in a completely symbolic form, with the intention that the reader can produce a formal statement from the (8)\_\_\_\_\_ one.

The text adapted from <https://en.wikipedia.org/wiki/Theorem>

**3. Which well-known/interesting/important theorems can you comment on in English? Do you know anything about their history or proofs?**

## **4 The Four Color Theorem**

### **4.1 Do you know the answers for the following questions?**

- a) What does the Four Color Theorem state?
- b) How long did it take to prove this theorem?
- c) When was the theorem solved?
- d) Which famous mathematician was involved with the appearance of the Four Color Problem?
- e) How can this theorem be proven?
- f) Why was the first proof considered controversial?

### **4.2 Watch the video and check/find the answers for questions 4.1 a) - e):**

<https://youtu.be/NgbK43jB4rQ>, 0:00 - 1:54.

### **4.3 Read the text about proving the Four Color Theorem and answer the questions below.**

In mathematics, the four color theorem, or the four color map theorem, states that given any separation of a plane into contiguous regions, called a map, the regions can be colored using at most four colors so that no two adjacent regions have the same color. Two regions are called adjacent only if they share a border segment, not just a point.

Three colors are adequate for simpler maps, but an additional fourth color is required for some maps, such as a map in which one region is surrounded by an odd number of other regions that touch each other in a cycle. The five color theorem, which has a short elementary proof, states that five colors suffice to color a map and was proven in the late 19th century, however, proving four colors suffice turned out to be significantly harder. A number of false proofs and false counterexamples have appeared since the first statement of the four color theorem in 1852.

The four color theorem was proven in 1976 by Kenneth Appel and Wolfgang Haken. It was the first major theorem to be proven using a computer. Appel and Haken's approach started by showing there is a particular set of 1,936 maps, each of which cannot be part of a smallest-sized counterexample to the four color theorem. Appel and Haken used a special-purpose computer program to check each of these maps had this property. Additionally, any map (regardless of whether it is a counterexample or not) must have a portion that looks like one of these 1,936 maps. To show this required hundreds of pages of hand analysis. Appel and Haken concluded that no smallest counterexamples existed because any must contain, yet not contain, one of these 1,936 maps. This contradiction means there are no counterexamples at all and the theorem is true. Initially, their proof was not accepted by all mathematicians because the computer-assisted proof was infeasible for a human to check by hand.

To dispel remaining doubt about the Appel–Haken proof, a simpler proof using the same ideas and still relying on computers was published in 1997 by Robertson, Sanders, Seymour, and Thomas. Additionally in 2005, the theorem was proven by Georges Gonthier with general purpose theorem proving software.

The text from [https://en.wikipedia.org/wiki/Four\\_color\\_theorem](https://en.wikipedia.org/wiki/Four_color_theorem)

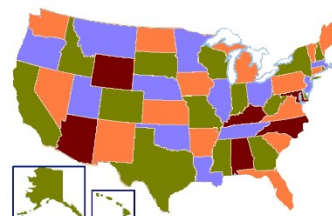
**a) Answer Qs, using the information from the text.**

- What are adjacent regions?
- What kinds of maps need four colors?
- When was the five color theorem proven?
- How was the four color theorem proven?
- Why was the proof unacceptable?
- Which methods of proving the theorem were used in 2005?

**b) EXAM PRACTICE. Find words from the text which are synonyms for the expressions below. The words occur in the text in the same order as their explanations. An example has been done for you:**

Example: adjacent: contiguous

- sufficient .....
- to be enough .....
- a part .....
- at first .....
- impossible .....
- adjacent .....
- to put to rest .....



A four-coloring of an actual map of the states of the [United States](https://upload.wikimedia.org/wikipedia/commons/a/a9/Map_of_United_States_vivid_colors_shown.png) (ignoring lakes).  
[https://upload.wikimedia.org/wikipedia/commons/a/a9/Map\\_of\\_United\\_States\\_vivid\\_colors\\_shown.png](https://upload.wikimedia.org/wikipedia/commons/a/a9/Map_of_United_States_vivid_colors_shown.png)

**c) Which methods of proof were mentioned in the video and the texts? Which other methods of proof do you know?**