

```
\documentclass[a4paper]{article}
\usepackage[utf8]{inputenc}
\usepackage[margin=2.54cm]{geometry}
\usepackage{fancyhdr}
\pagestyle{fancy}

\title{My document}
\author{Vincent Kuhlmann}
\date{1 May 2021}

\begin{document}
  \maketitle
  \section{Introduction}

  Hello everyone!
\end{document}
```

## 1 Definities

**Raakruimte:** Een vectorruimte  $T_p M$  die hoort bij een punt  $p$  op een variëteit  $M$ .

**Vector:** Een element  $v$  uit de raakruimte, die gezien kan worden als de snelheid van een pad door het punt  $p$ .

**Varïëteit:** Een ruimte zodat

1. De ruimte een topologie heeft;
2. Rondom elk punt een omgeving is te kiezen en een homeomorfisme naar Euclidische ruimte;
3. De ruimte Hausdorff is, d.w.z. de topologie kan elke twee punten onderscheiden.
  - Vaak wordt ook gevraagd dat de ruimte paracompact is of dat de topologie een atotbare basis heeft.

## 2 Raakruimtes

### 2.1 Plaatje

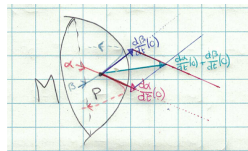


Figure 1: Deze tekening laat zien hoe een raakruimte aan een gladde variëteit is te visualiseren, dit is een vectorruimte dus kunnen we twee vectoren optellen.

# Pagina lay-out en dimensies

document/document-geometry-fancyhdr

`\fancyhead[L]{} \fancyhead[C]{} \fancyhead[R]{}`

## 1 Lorem ipsum

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Suspendisse tincidunt eleifend enim, ut pharetra mi.

```
\usepackage{geometry}
\usepackage{fancyhdr}

\geometry{
  a6paper,
  %landscape,
  margin=2cm,
  left=1cm,
  right=1cm,
  paperheight=12cm
}

\pagestyle{fancy}
\fancyhead[L]{Linksboven!}
\begin{document}
...
\end{document}
```

`\fancyfoot[L]{} \fancyfoot[C]{} \fancyfoot[R]{}`

```
\usepackage{geometry}
\usepackage{fancyhdr}
```

```
\geometry{
  a6paper,
  landscape,
  margin=2cm,
  left=1cm,
  paperheight=12cm
}

\pagestyle{fancy}
\fancyhead[L]{Linksboven!}
```

Vincent's favorite package: `\usepackage[bookmarks]{document/document-hyperref}`

The screenshot shows a PDF viewer interface. On the left is a table of contents with the following structure:

- Preface
- ▼ Introduction
  - Hilbert and the Motivation for Logic
  - What Is to Be Found in This Book?
- Contents
- ▼ 1 Sets
  - ▼ 1.1 Cardinal Numbers
    - 1.1.1 The Continuum Hypothesis
  - 1.2 The Axiom of Choice
  - 1.3 Partially Ordered Sets and Zorn's Lemma
  - 1.4 Well-Ordered Sets
  - 1.5 Principles Equivalent to the Axiom of Choice
- ▼ 2 Models
  - 2.1 Rings and Orders: Examples
  - ▼ 2.2 Languages of First-Order Logic
    - 2.2.1 Free and Bound Variables
    - 2.2.2 Legitimate Substitutions
    - 2.2.3 First-Order Logic and Other Kinds of Logic
  - ▼ 2.3 Structures for First-Order Logic
    - 2.3.1 Validity and Equivalence of Formulas
  - ▼ 2.4 Examples of Languages and Structures

The main content area shows page 69 (83 of 151) with a zoom level of 150%. The text on the page is as follows:

and  $\vec{a} = a_1, \dots, a_n$  and  $\vec{b} = b_1, \dots, b_n$  tuples of elements of  $M$  and  $N$ , respectively. Write  $\vec{a} \equiv_{\Gamma} \vec{b}$  if for every formula  $\phi(x_1, \dots, x_n)$  from  $\Gamma$  we have:

$$M \models \phi(a_1, \dots, a_n) \Leftrightarrow N \models \phi(b_1, \dots, b_n).$$

We shall apply this for  $\Gamma$  the set of quantifier-free  $L$ -formulas and for  $L$  simple  $L$ -formulas; in which case we write  $\vec{a} \equiv_{\text{qf}} \vec{b}$ ,  $\vec{a} \equiv_{\text{simple}} \vec{b}$ , respectively.

**Lemma 2.7.4** *Let  $L$  be an arbitrary language. Suppose that an  $L$ -theory  $T$  has the following property:*

Whenever  $M$  and  $N$  are models of  $T$ , and  $\vec{a} = a_1, \dots, a_n$ ,  $\vec{b} = b_1, \dots, b_n$  tuples of elements of  $M$  and  $N$ , respectively, then  $\vec{a} \equiv_{\text{qf}} \vec{b}$  implies  $\vec{a} \equiv_T \vec{b}$ .

*Then  $T$  has quantifier elimination.*

**Proof.** Assume that  $T$  has the property in the statement of the lemma. By Lemma 2.7.2 we have to show that every simple  $L$ -formula is  $T$ -equivalent to a quantifier-free formula in the same free variables. So, let  $\exists v \phi(v, \vec{w})$  be a formula, with  $\vec{w} = w_1, \dots, w_n$  the free variables. Let  $\vec{c} = c_1, \dots, c_n$  constants; we write  $L_{\vec{c}}$  for  $L \cup \{c_1, \dots, c_n\}$ .

Let  $\Gamma$  be the set of all quantifier-free  $L$ -formulas  $\psi(\vec{w})$  such that

$$T \models (\exists v \phi(v, \vec{c})) \rightarrow \psi(\vec{c})$$

```
% Bestand: prachtigeformule.tex
\documentclass{standalone}
\usepackage{amsmath,amssymb}

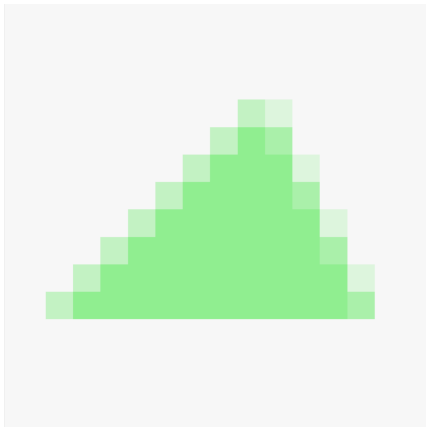
\begin{document}
  $\displaystyle\sum_{k=0}^{\infty}
  \frac{x^k}{k!}=e^x$
\end{document}
```

```
\includegraphics[...]{prachtigeformule.pdf}
```

$$\sum_{k=0}^{\infty} \frac{x^k}{k!} = e^x$$

## Raster vs vector graphics

**Raster** (.png, .jpg, .jpeg, .bmp)



document/document-latex-to-svg

**Vector** (.pdf, .svg, .dvi, .ps)

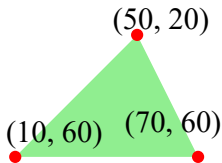
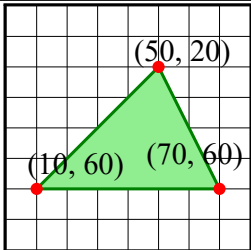


# Raster vs vector graphics

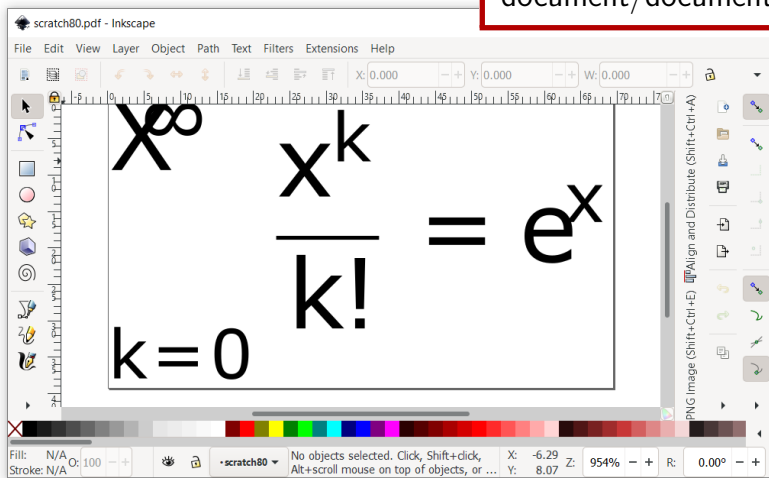
document/document-latex-to-svg

```
assets > images > vector_vs_raster-vector.svg
```

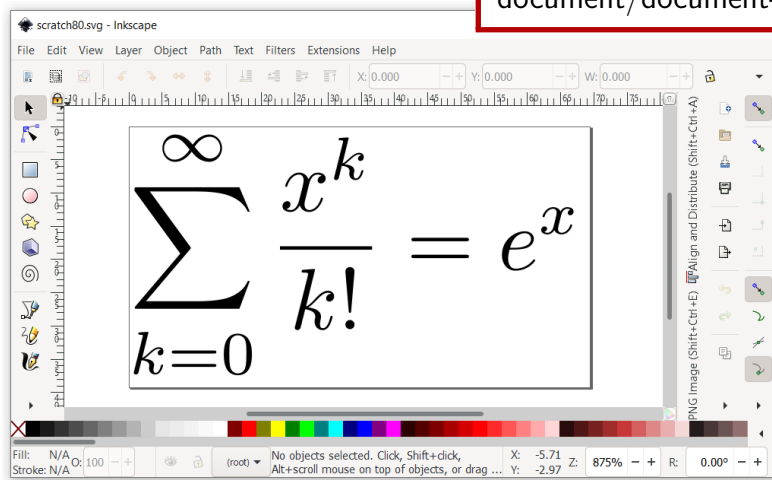
```
1 <svg version="1.1"  
2   width="80" height="80"  
3   xmlns="http://www.w3.org/2000/svg">  
4   <path d="M50 20 L70 60 L10 60 Z" fill="lightgreen" />  
5 </svg>
```



document/document-latex-to-svg



document/document-latex-to-svg





document/document-latex-to-svg

```
PS D:\Projects\latexscratch\outdir> pdf2svg scratch80.pdf scratch80.svg
PS D:\Projects\latexscratch\outdir> wsl pdftocairo -svg scratch80.pdf scratch80_alt2.svg
PS D:\Projects\latexscratch\outdir> |
```

Converteren van pdf naar svg met `pdf2svg` of met package `pdftocairo`. Voor laatste is Linux/Mac nodig of Windows Subsystem for Linux.

document/document-latex-to-svg

```
pdf2svg scratch80.pdf scratch80_alt.svg  
wsl pdftocairo -svg scratch80.pdf scratch80_alt2.svg
```

Converteren van pdf naar svg met `pdf2svg` of met package `pdftocairo`. Voor laatste is Linux/Mac nodig of Windows Subsystem for Linux.

#### 4.1.4 1-forms as $C^\infty(M)$ -linear functionals eating vector fields

While covectors of a vector space  $V$  take vectors to real numbers, 1-forms take vector given  $\omega$  as above and  $X \in \mathfrak{X}(M)$ , evaluating  $\omega_p$  on  $X_p$  for each  $p \in M$  we obtain a smc

$$\omega(X) \in \mathcal{C}^\infty(M);$$

(why smooth?). When we vary  $X$  it is clear that the resulting map, still denoted by  $\omega$ ,

$$\omega : \mathfrak{X}(M) \rightarrow \mathcal{C}^\infty(M)$$

is  $C^\infty(M)$ -linear, i.e. it is linear and

$$\omega(f \cdot X) = f \cdot \omega(X) \quad \text{for all } f \in \mathcal{C}^\infty(M), X \in \mathfrak{X}(M).$$

#### 4.1.4 1-forms as $C^\infty(M)$ -linear functionals eating vector fields

While covectors of a vector space  $V$  take vectors to real numbers, 1-forms take vector fields to smooth functions. Given  $\omega$  as above and  $X \in \mathfrak{X}(M)$ , evaluating  $\omega_p$  on  $X_p$  for each  $p \in M$  we obtain a smooth function

$$\omega(X) \in \mathcal{C}^\infty(M);$$

(why smooth?). When we vary  $X$  it is clear that the resulting map, still denoted by  $\omega$ ,

$$\omega : \mathfrak{X}(M) \rightarrow \mathcal{C}^\infty(M)$$

is  $C^\infty(M)$ -linear, i.e. it is linear and

$$\omega(f \cdot X) = f \cdot \omega(X) \quad \text{for all } f \in \mathcal{C}^\infty(M), X \in \mathfrak{X}(M).$$

$$\sum_{k=0}^{\infty} \frac{x^k}{k!} = e^x$$

$$\sum_{k=0}^{\infty}$$

$$\frac{x^k}{k!}$$

$$= e^x$$

# Page margins

document/document-margins

```
\documentclass{article}
\usepackage[utf8]{inputenc}

\title{My document}
\author{Vincent Kuhlmann}
\date{1 May 2021}

\begin{document}
  \maketitle
  \section{Introduction}

  Hello everyone!
\end{document}
```

My document  
Vincent Kuhlmann  
1 May 2021

1 Introduction  
Hello everyone!

# Page margins

document/document-margins

```
\documentclass[a4paper]{article}
\usepackage[utf8]{inputenc}
\usepackage[margin=2.54cm]{geometry}

\title{My document}
\author{Vincent Kuhlmann}
\date{1 May 2021}

\begin{document}
  \maketitle
  \section{Introduction}

  Hello everyone!
\end{document}
```

My document

Vincent Kuhlmann

1 May 2021

## 1 Introduction

Hello everyone!



# Page margins

document/document-margins

```
\documentclass[a4paper]{article}
\usepackage[utf8]{inputenc}
\usepackage[margin=2.54cm,left=-0.5cm]
{geometry}

\title{My document}
\author{Vincent Kuhlmann}
\date{1 May 2021}

\begin{document}
  \maketitle
  \section{Introduction}

  Hello everyone!
\end{document}
```

My document  
Vincent Kuhlmann  
1 May 2021

Introduction  
So interesting!

# Simple document

document/document-parts

```
\documentclass{article}

\usepackage[utf8]{inputenc}

\title{My document}
\author{Vincent Kuhlmann}
\date{1 May 2021}
```

```
\begin{document}
\maketitle
\section{Introduction}

Hello everyone!
\end{document}
```

## Preamble

My document

Vincent Kuhlmann

1 May 2021

## 1 Introduction

Hallo iedereen!

## Document

# Partial numbering

```
\setcounter{secnumdepth}{3}  
\section{AA}  
Lorem ipsum dolor sit amet,  
consectetur adipiscing elit.
```

```
\section{BB}  
\subsection{CC}  
\subsubsection{DD}  
\subsection{EE}  
Nullam a risus at arcu  
lobortis viverra vel  
volutpat diam.
```

```
\section{FF}  
\subsubsection{GG}
```

document/document-secnumdepth

## 1 AA

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

## 2 BB

### 2.1 CC

#### 2.1.1 DD

### 2.2 EE

Nullam a risus at arcu lobortis viverra vel volutpat diam.

## 3 FF

### 3.0.1 GG

# Partial numbering

```
\setcounter{secnumdepth}{2}  
\section{AA}  
Lorem ipsum dolor sit amet,  
consectetur adipiscing elit.
```

```
\section{BB}  
\subsection{CC}  
\subsubsection{DD}  
\subsection{EE}  
Nullam a risus at arcu  
lobortis viverra vel  
volutpat diam.
```

```
\section{FF}  
\subsubsection{GG}
```

document/document-secnumdepth

## 1 AA

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

## 2 BB

### 2.1 CC

DD

### 2.2 EE

Nullam a risus at arcu lobortis viverra vel volutpat diam.

## 3 FF

GG

# Partial numbering

```
\setcounter{secnumdepth}{1}  
\section{AA}  
Lorem ipsum dolor sit amet,  
consectetur adipiscing elit.
```

```
\section{BB}  
\subsection{CC}  
\subsubsection{DD}  
\subsection{EE}  
Nullam a risus at arcu  
lobortis viverra vel  
volutpat diam.
```

```
\section{FF}  
\subsubsection{GG}
```

document/document-secnumdepth

## 1 AA

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

## 2 BB

CC

DD

EE

Nullam a risus at arcu lobortis viverra vel volutpat diam.

## 3 FF

GG

## Partial numbering

```
\setcounter{secnumdepth}{0}  
\section{AA}  
Lorem ipsum dolor sit amet,  
consectetur adipiscing elit.
```

```
\section{BB}  
\subsection{CC}  
\subsubsection{DD}  
\subsection{EE}  
Nullam a risus at arcu  
lobortis viverra vel  
volutpat diam.
```

```
\section{FF}  
\subsubsection{GG}
```

document/document-secnumdepth

**AA**

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

**BB**

**CC**

**DD**

**EE**

Nullam a risus at arcu lobortis viverra vel volutpat diam.

**FF**

**GG**

# Section commands

document/document-sections

```
\section{AA}  
Lorem ipsum dolor sit amet,  
consectetur adipiscing elit.
```

```
\section{BB}  
\subsection{CC}  
\subsubsection{DD}  
\subsection{EE}  
Nullam a risus at arcu  
lobortis viverra vel  
volutpat diam.
```

```
\section{FF}  
\subsubsection{GG}
```

## 1 AA

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

## 2 BB

### 2.1 CC

#### 2.1.1 DD

### 2.2 EE

Nullam a risus at arcu lobortis viverra vel volutpat diam.

## 3 FF

### 3.0.1 GG

# Partial numbering

```
\section{AA}  
Lorem ipsum dolor sit amet,  
consectetur adipiscing elit.
```

```
\section*{BB}  
\subsection*{CC}  
\subsubsection{DD}  
\subsection*{EE}  
Nullam a risus at arcu  
lobortis viverra vel  
volutpat diam.
```

```
\section{FF}  
\subsubsection{GG}
```

document/document-section-star

## 1 AA

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

## BB

### CC

#### 1.0.1 DD

### EE

Nullam a risus at arcu lobortis viverra vel volutpat diam.

## 2 FF

#### 2.0.1 GG



# Subfiles

document/document-subfiles

```
thesis.tex  
section1.tex  
section2.tex  
...
```

```
% File: section1.tex  
% !TEX root=section1.tex  
\documentclass  
    [thesis.tex]{subfiles}  
\begin{document}  
    \section{Section 1}  
    ...  
\end{document}
```

```
% File: thesis.tex  
\documentclass  
    [a4paper]{article}  
\usepackage{subfiles}  
  
\begin{document}  
    ...  
    \subfile{section1.tex}  
    \subfile{section2.tex}  
\end{document}
```

# Contents

document/document-toc

```
\begin{document}
  \maketitle
  \tableofcontents

  \section{AA}
  ...
\end{document}
```

## Contents

<b>1</b>	<b>AA</b>	<b>1</b>
<b>2</b>	<b>BB</b>	<b>2</b>
2.1	CC . . . . .	2
2.1.1	DD . . . . .	2
2.2	EE . . . . .	2
<b>3</b>	<b>FF</b>	<b>2</b>
3.0.1	GG . . . . .	2

## 1 AA

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

# Contents

document/document-toc

```
\begin{document}
  \maketitle
  \tableofcontents
  \newpage

  \section{AA}
  ...
\end{document}
```

## Contents

<b>1</b>	<b>AA</b>	<b>2</b>
<b>2</b>	<b>BB</b>	<b>2</b>
2.1	CC . . . . .	2
2.1.1	DD . . . . .	2
2.2	EE . . . . .	2
<b>3</b>	<b>FF</b>	<b>2</b>
3.0.1	GG . . . . .	2

# Contents

document/document-toc

```
...  
\usepackage[dutch]{babel}  
  
\begin{document}  
  \maketitle  
  \tableofcontents  
  \newpage  
  
  \section{AA}  
  ...  
\end{document}
```

## Inhoudsopgave

<b>1</b>	<b>AA</b>	<b>2</b>
<b>2</b>	<b>BB</b>	<b>2</b>
2.1	CC . . . . .	2
2.1.1	DD . . . . .	2
2.2	EE . . . . .	2
<b>3</b>	<b>FF</b>	<b>2</b>
3.0.1	GG . . . . .	2

Kom bij de T<sub>E</sub>XnietCie!

3 *SETUP AND METHOD*

Nunc feugiat purus lorem, in pulvinar leo accumsan quis. Maecenas tristique sollicitudin venenatis. Phasellus imperdiet urna quis augue ornare condimentum. Cras euismod nisi convallis ipsum ultricies aliquet. Suspendisse accumsan vulputate accumsan. Aliquam vehicula sapien quis egestas venenatis. Nam suscipit imperdiet eros eget finibus. Interdum et malesuada fames ac ante ipsum primis in faucibus. Quisque porta ultricies eros nec po-

tas. Cras a convallis mi, a finibus felis. Nunc quis nisi non magna tincidunt tincidunt. Maecenas cursus, velit non dapibus gravida, quam dui condimentum leo, ac egestas tellus sem a est. Pellentesque convallis sollicitudin commodo. Nulla non viverra sapien.

Etiam sit amet neque rutrum, semper ex et, vehicula diam. Aliquam iaculis dignissim accumsan. Integer vel suscipit ligula, at efficitur nulla. Proin iaculis quam at

```
\documentclass[a4paper,twocolumn]{article}
\usepackage[margin=2.54cm]{geometry}
\usepackage{fancyhdr}
\pagestyle{fancy}
```