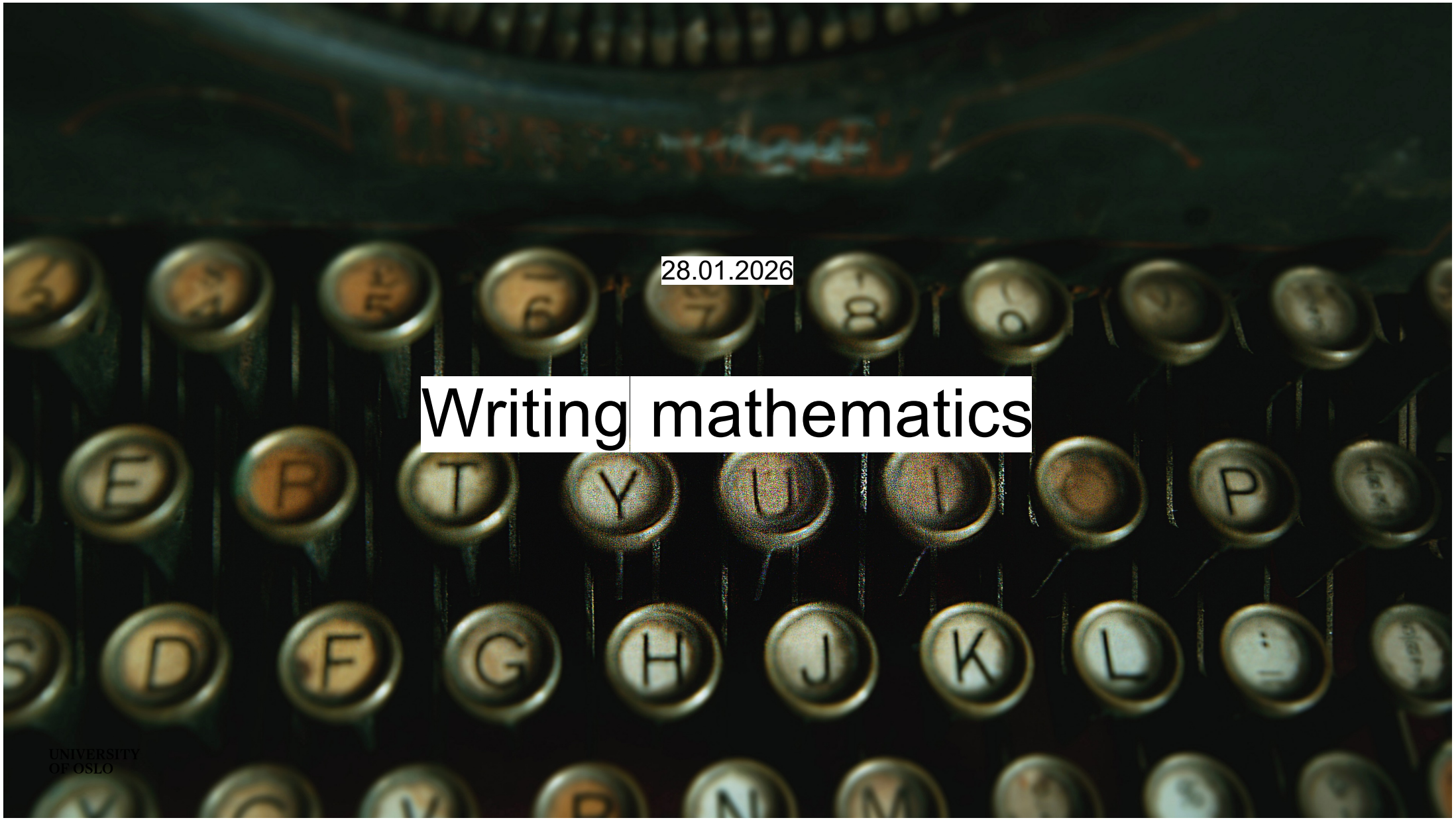
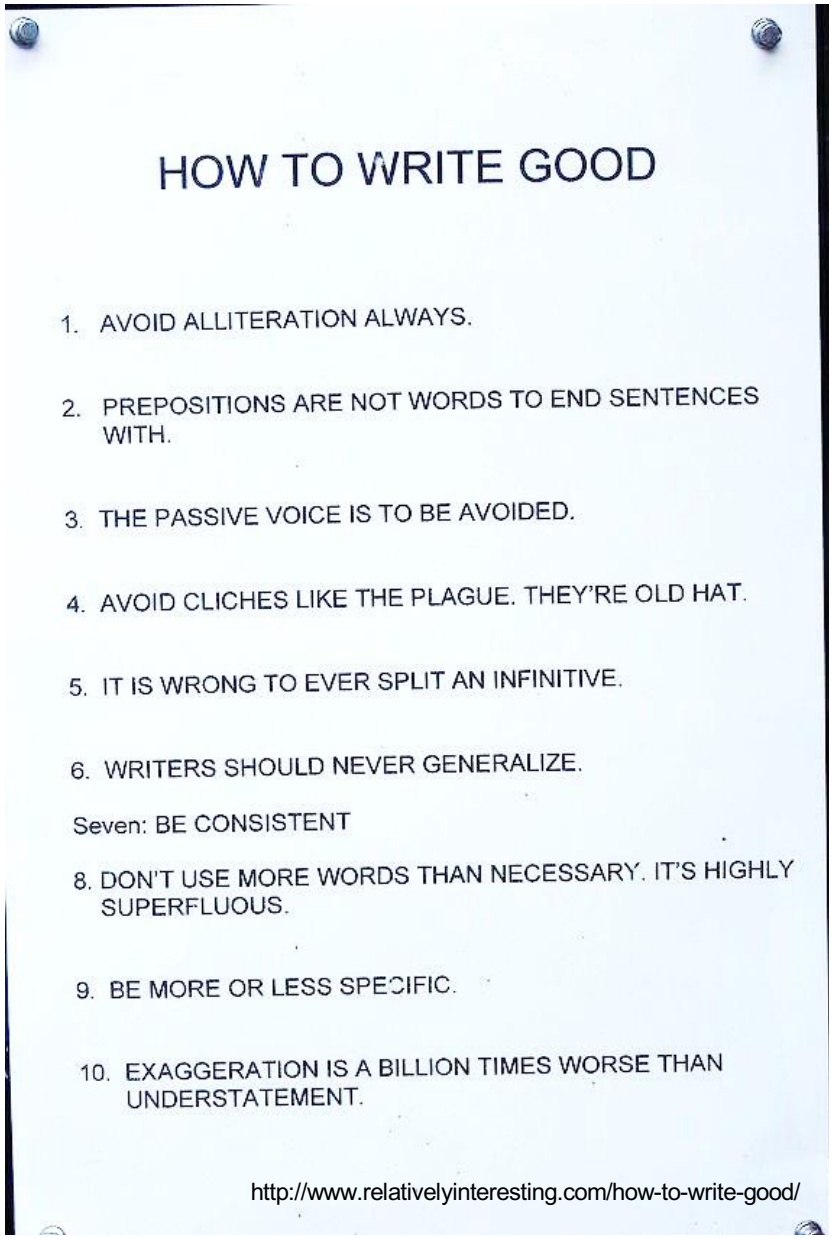


28.01.2026

Writing mathematics

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HOW TO WRITE GOOD

1. AVOID ALLITERATION ALWAYS.
2. PREPOSITIONS ARE NOT WORDS TO END SENTENCES WITH.
3. THE PASSIVE VOICE IS TO BE AVOIDED.
4. AVOID CLICHES LIKE THE PLAGUE. THEY'RE OLD HAT.
5. IT IS WRONG TO EVER SPLIT AN INFINITIVE.
6. WRITERS SHOULD NEVER GENERALIZE.

Seven: BE CONSISTENT

8. DON'T USE MORE WORDS THAN NECESSARY. IT'S HIGHLY SUPERFLUOUS.
9. BE MORE OR LESS SPECIFIC.
10. EXAGGERATION IS A BILLION TIMES WORSE THAN UNDERSTATEMENT.

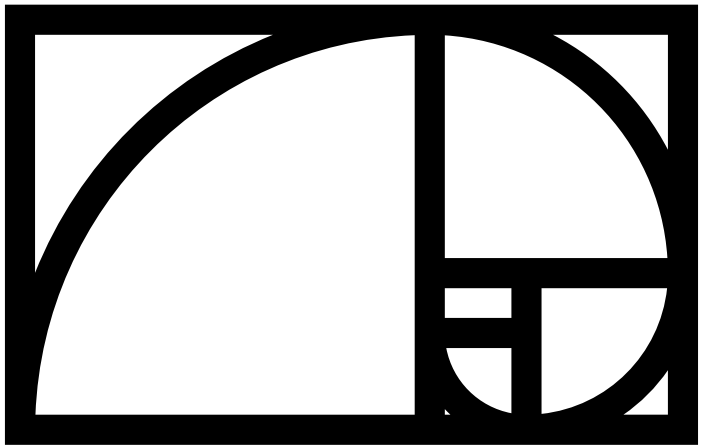
http://www.relativelyinteresting.com/how-to-write-good/

Writing in mathematics

Mathematics happens NON-linearly but is presented linearly

Be precise, concise and focused!

- Strong contrast to a novel or popular science
- Every word has a specific meaning
- Stay focused on results
- Consider *writing backwards* from main results

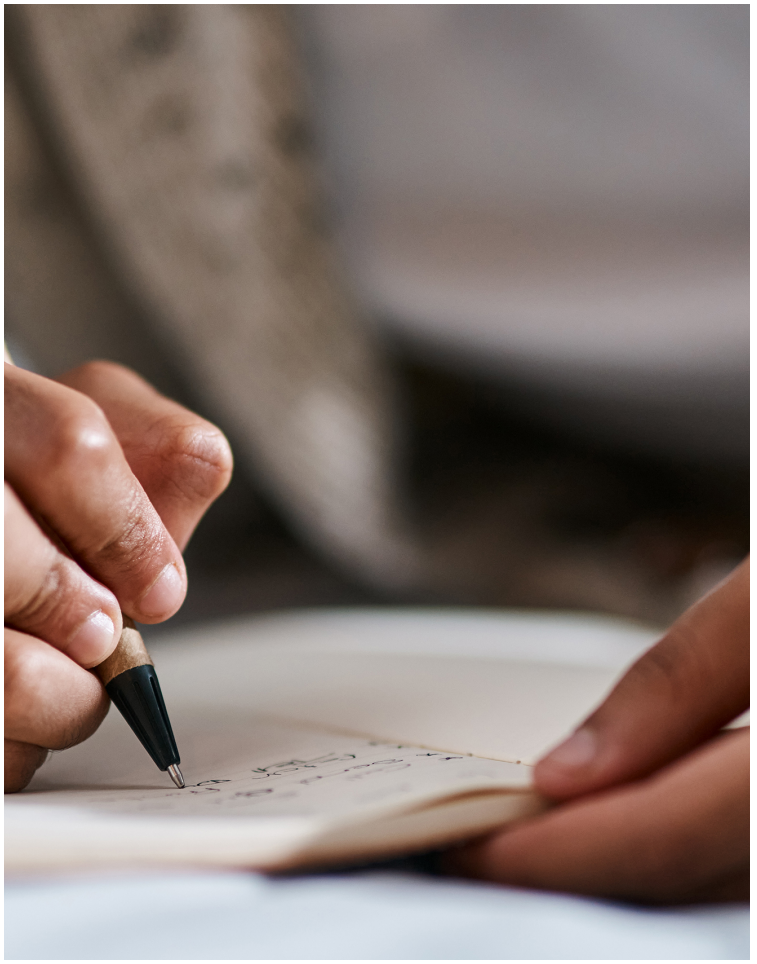


See Halmos: *Write in Spirals* Section 7 of *How to write mathematics*

General advice

- Say something!
- Speak to someone! (decide on audience)
- Invite the reader into your text and make it easy
- Very abstract content requires examples
- Don’t over- or underestimate the reader
- Make your intentions clear
- Organise and build structure
- Know when to stop!

See Halmos *How to write mathematics*



The process

You write for yourself, not only your audience

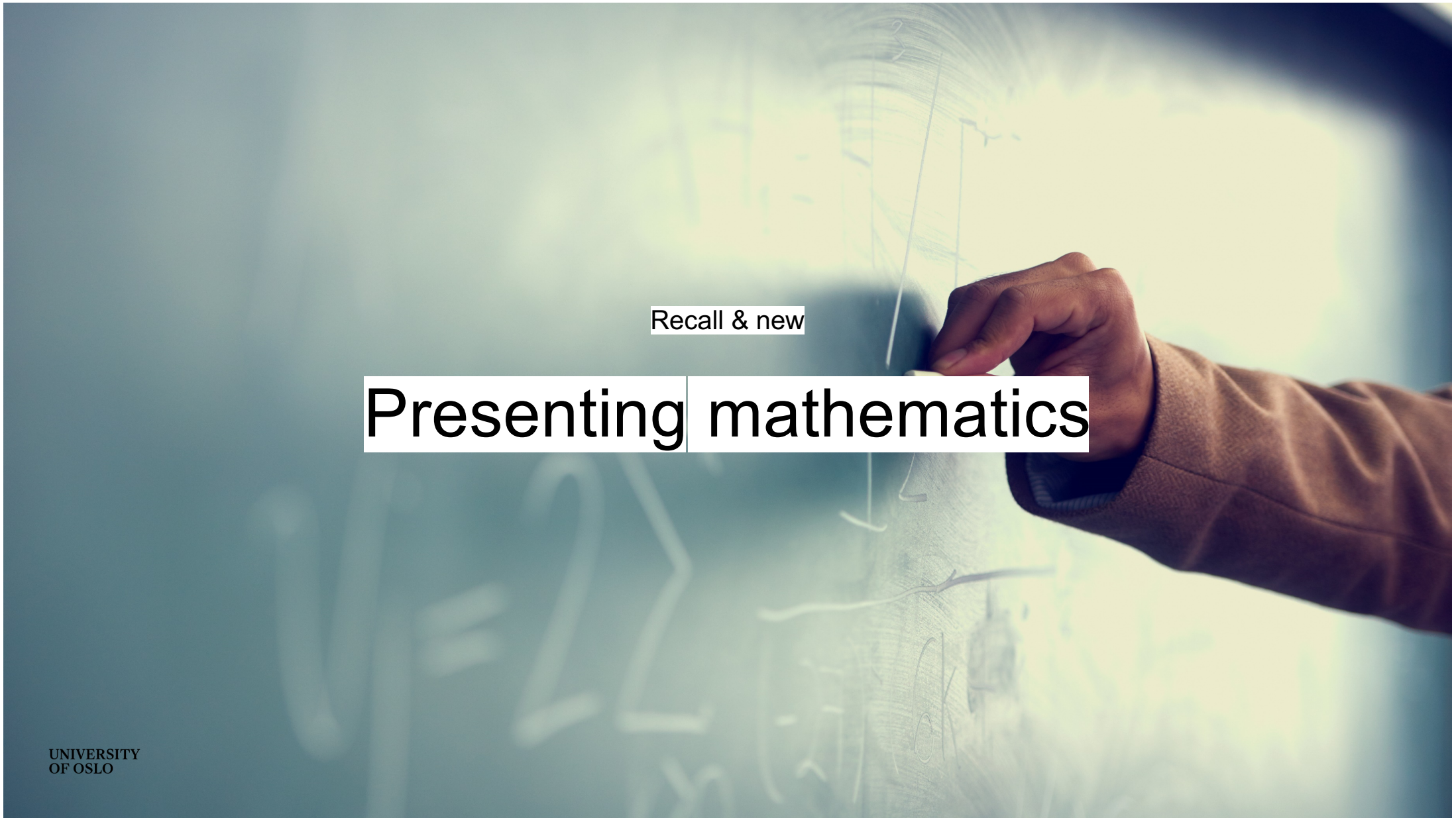
- Write immediately and often
- Write to create structure
- Write to learn
- Write to find results and clarify how your results are connected
- Write to correct yourself and get the details right
- Write to be efficient and finish on time
- Expect to write everything at least 2-3 times
- **Do NOT use generative AI!**
- The 30%-rule
  - Let your supervisor in on your 30% draft
  - Expect feedback accordingly
- Academic writing centre



Choosing language

- English
  - Most science is in English
  - Easily shared with other researchers
  - Easy to find technical terminology
- Norwegian
  - Spend less time on grammar and spelling and more time on math
  - Better understanding
- Dictionary https://matematikkradet.no/ordliste/

- Ask your supervisor!
- Use a dictionary
- Use a spell checker
- Read up on grammar
- Keep it simple



Recall & new

Presenting mathematics

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Doing versus writing math

Solve the equation: $3^{2x} - 2(3^x) = -1$.

$$3^{2x} - 2(3^x) = -1 \;=\; (3^x)^2 - 2(3^x) + 1 = 0 \;=\; (3^x - 1)^2 = 0 \;=\; 3^x = 1 \;=\; x = 0.$$

$$3^{2x} - 2(3^x) = -1 \;\rightarrow\; (3^x)^2 - 2(3^x) + 1 = 0 \;\rightarrow\; (3^x - 1)^2 = 0 \;\rightarrow\; 3^x = 1 \;\rightarrow\; x = 0.$$

$$\begin{aligned} 3^{2x} - 2(3^x) &= -1 && \text{Solve this equation.} \\ (3^x)^2 - 2(3^x) + 1 &= 0 && \text{Collect the terms on one side.} \\ (3^x - 1)^2 &= 0 && \text{Factor.} \\ 3^x &= 1 && \text{Use the Zero Factor Property.} \\ x &= 0 && \text{Solve for } x. \end{aligned}$$

We want to solve for x in the equation

$$3^{2x} - 2(3^x) = -1.$$

We can rewrite this equation in terms of 3^x:

$$(3^x)^2 - 2(3^x) + 1 = 0.$$

After factoring, this becomes

$$(3^x - 1)^2 = 1$$

and it follows that $3^x = 1$, or $x = 0$.

How and when to define notation

The volume is ℓwh.



http://web.cs.ucdavis.edu/~amenta/w10/writingman.pdf

How and when to define notation

The following example is adequate, but wordy.

> The volume of the box is ℓwh, where ℓ is the length, w is the width, and h is the height.

We can write this most elegantly by removing the variables.

> The volume of the box is the product of the length, the width, and the height.



!

http://web.cs.ucdavis.edu/~amenta/w10/writingman.pdf

Respect notation/variables

Let P be the escaped wombat population (in thousands) t years after 1990 and suppose that

$$P = 0.5(1.12)^t.$$

The wombat population in 1992 is approximately 672. We can see this by setting $t = 2$ and observing that

$$P = 0.5(1.12)^2 = 0.6272 \text{ thousand wombats.}$$

If we want to predict when the wombat population will reach 2000, we set $P = 2$ and solve for t using logarithms.

$$\begin{aligned} 2 &= 0.5(1.12)^t \\ \log 2 &= \log 0.5 + t \log 1.12 \\ t &= \frac{\log 2 - \log 0.5}{\log 1.12} \approx 12.23 \text{ years.} \end{aligned}$$

The wombat population will reach 2000 in the year 2002.

Let P be the escaped wombat population (in thousands) t years after 1990 and suppose that

$$P = 0.5(1.12)^t.$$

By substituting 2 for t in the above equation, we can see that in 1992, the wombat population is approximately 672.

$$0.5(1.12)^2 = 0.6272 \text{ thousand wombats.}$$

Let t_{2000} be the year when the wombat population reaches 2000. Then,

$$\begin{aligned} 2 &= 0.5(1.12)^{t_{2000}} \\ \log 2 &= \log 0.5 + t_{2000} \log 1.12 \\ t_{2000} &= \frac{\log 2 - \log 0.5}{\log 1.12} \approx 12.23 \text{ years.} \end{aligned}$$

The wombat population will reach 2000 in the year 2002.

http://web.cs.ucdavis.edu/~amenta/w10/writingman.pdf

Typesetting mistakes

- I like
$$e^{-i\pi} + 1 = 0$$
, since it includes all of my favourite constants.
- We have $x^2 + 1 \in S$, $x \in \mathbb{R}$
- For the polynomial $ax^2 + bx + c$, the discriminant $\Delta = b^2 - 4ac$.
- H denotes the Sylow p-subgroup of G.
- It follows that x plus two is larger than zero.

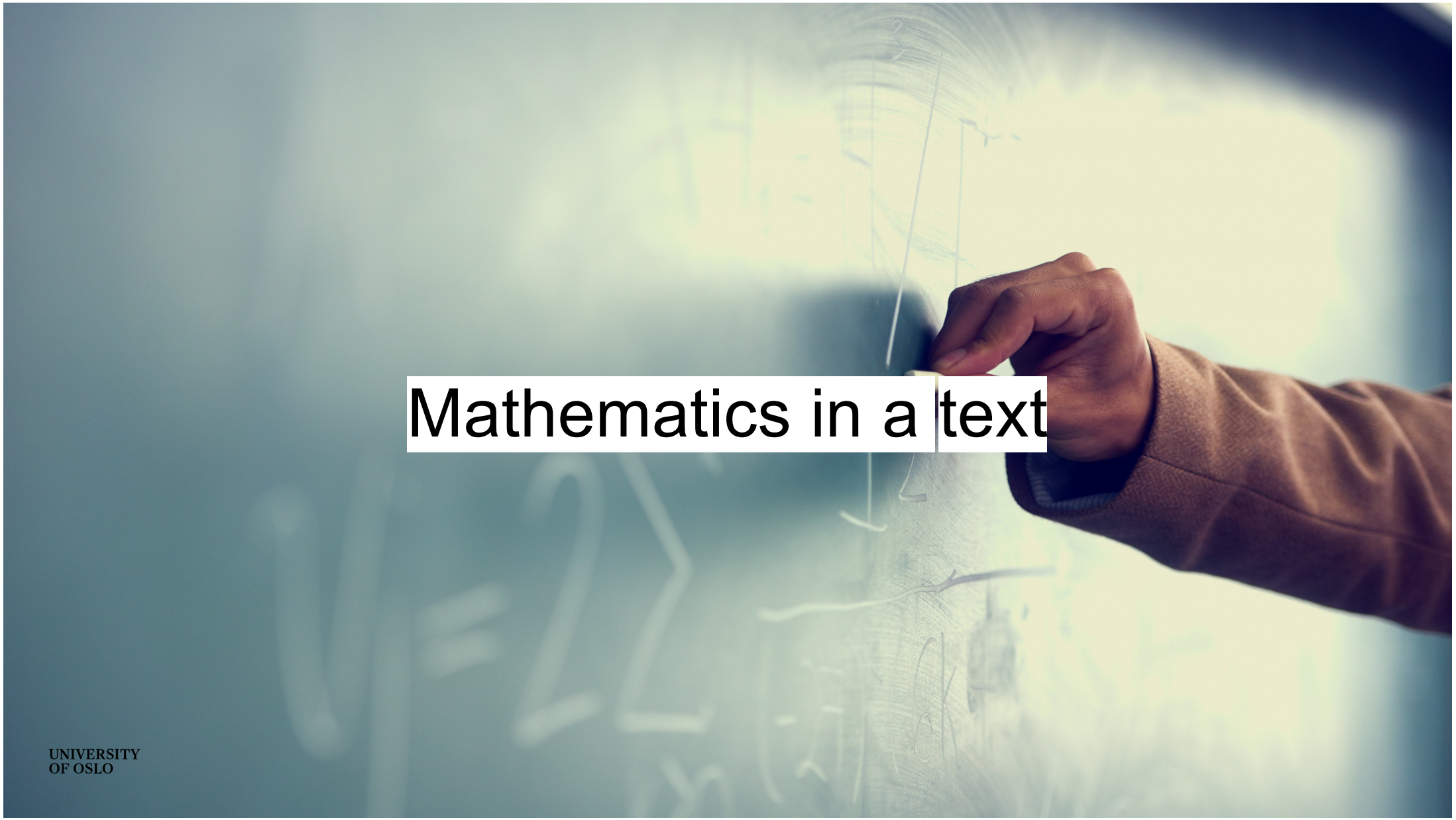
https://usf.fyi/writingmath/. http://web.cs.ucdavis.edu/~amenta/w10/writingman.pdf

Typesetting mistakes

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- H denotes the Sylow p-subgroup of G.
- It follows that x plus two is larger than zero.

- I like
$$e^{-i\pi} + 1 = 0,$$
since it includes all of my favourite constants.
- We have $x^2 + 1 \in S$ for all $x \in \mathbb{R}$.
- For the polynomial $ax^2 + bx + c$, the discriminant Δ equals $b^2 - 4ac$.
- Let H denote the Sylow p-subgroup of G.
- It follows that $x + 2 > 0$.

https://usf.fyi/writingmath/. http://web.cs.ucdavis.edu/~amenta/w10/writingman.pdf



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Notation and definitions

- Introduce and explain most technical terms and symbols that are used
  - Separate environments
  - Emphasized
- Proximity – minimize the distance between notation/definition and first use
- Make sure that your text can be read by others (including yourself now **and** a few years from now)
- Some terms and notation must be considered well known to your audience
- Use standard notation

- In definitions: *if* means *if and only if*
- *Italicize* \emph{} the word that is being defined

Common words and phrases

- Let
- Denote
- Write

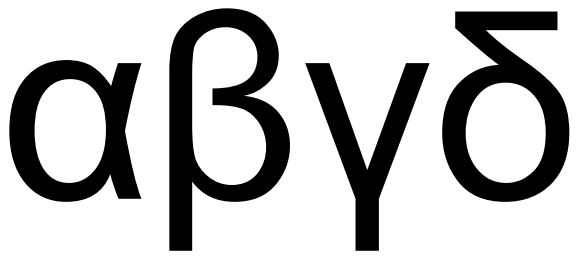
Using symbols

Three golden rules

- Don’t introduce unnecessary symbols
- Define all symbols before they are used
- Don’t start a sentence with symbols or notation!

Three typical mistakes

- One thing is referred to by two different symbols
- One symbol means two things
- Breaking the golden rules



Alpha and Omega

A lot of symbols

- Latin alphabet
- Greek alphabet
- Small or capital letters
- Caligraphic letters
- Upright letters
- Boldface letters
- Math symbols must be in math environment
  - Looks almost like *italic*
  - Upright math **symbols** look unprofessional
- Math operators are upright
  - $\tan(x), \ln(x), \gcd(m, n)$
  - Italic math **operators** look unprofessional



Symbols can be decorated

- Indexes, subscripts, superscripts
- Hats, curls, arrows, lines, stars, dots…
- Be consistent
- Avoid the Christmas tree
- Pro tip: shorthand in LaTeX

$$W_{\mathbf{a}} = q_{\mathbf{a}}^* H^0 \left(P_{\mathbf{a}}^{1,d}, \Omega^1_{P_{\mathbf{a}}^{1,d}}(\log L) \right) \subset H^0 \left(P^{r,d}, \Omega^1_{P^{r,d}}(\log L) \right).$$

[Detexify]

Symbols and parenthesis

- Never start a sentence with a mathematical expression or symbol
- Follow conventions
  - Functions *(f,g,h)*
  - Sets *(A,B)*
  - Indices *(i,j,k)*
  - Small things (*δ,ε*)
  - Vectors (Bold/arrow)
  - Different conventions
  - See the textbook / main reference
- Avoid special characters in title and abstract

- Keep an eye on the parentheses
  - Correct number
  - Correct nesting {[()]}
  - Correct size
  - Correct place
  - Readability
  - Line breaks
- Look out for the indices
  - Subscript and superscript
  - In LaTeX need {}

$$W_{\mathbf{a}} = q_{\mathbf{a}}^* H^0\left(P_{\mathbf{a}}^{1,d}, \Omega^1_{P_{\mathbf{a}}^{1,d}}(\log L)\right) \subset H^0\left(P^{r,d}, \Omega^1_{P^{r,d}}(\log L)\right).$$

Some useful things to remember

- “The” or “A”? (Unique or one of many)
- Stay consistent
  - Do not use synonyms in notation
  - Roots or exponents?
  - Vectors (arrows, bold, double)
- If you work with complex numbers, don’t count with “i”
- “kth term” (note the mathmode k, no superscript “th” and no ‘ or – before th)
- Different ellipses: … or ⋯?
  - Baseline between elements in lists
  - Vertically centered between operators
- Multiplication sometimes needs a vertically centered dot \cdot


Presenting results

Introducing a result

What does the reader need?

- Introductory and transitional text
- Notation/definition or reference to notation/definition before the result
- An appropriate environment in LaTeX
- Continuous (!) numbering for later reference!
- Don’t use adjectives alone to describe results (interesting, cool, nice, wonderful)
- Be specific and describe how they can be used (because)



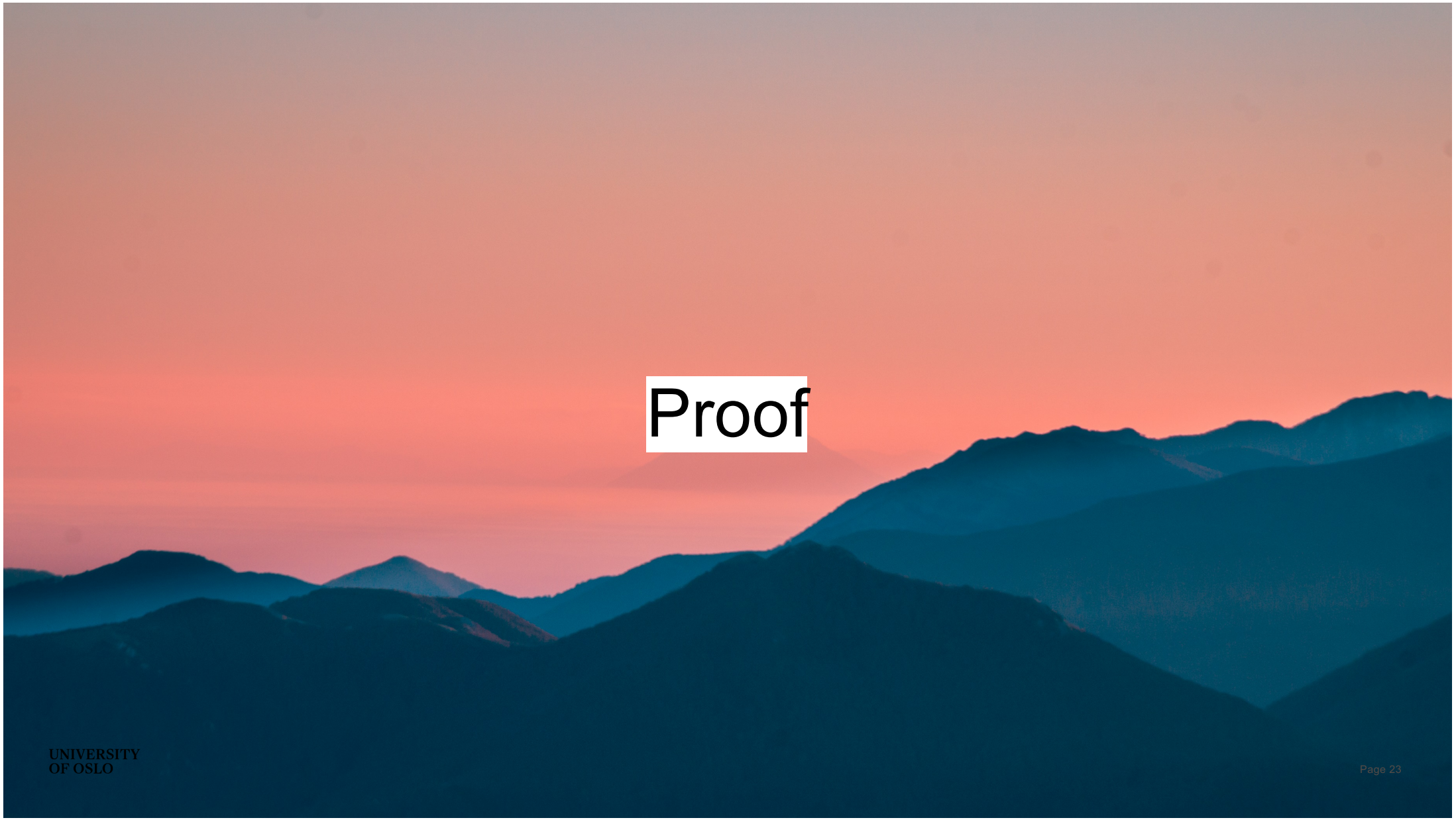
Introducing a result II

Who did what?

- Distinguish between your own and others' results
- Never take credit for something someone else did
- Take all the credit for the things you did on your own (with help from supervisor)
- **See Kowalski: About citations**
  https://web.williams.edu/Mathematics/sjmiller/public_html/mathematical_citation_guidelines.pdf

Subtle differences matter

- «We define» vs. «Is defined as»
- Who proved the theorem?
  - «We prove theorem X…»
  - «We give a proof of theorem X…»
  - «We present a proof of theorem X following A…»
  - «We present the proof given by A of theorem X…»
  - «We give a new proof of theorem X…»


Proof

Writing a proof

Identify the type of proof

- Direct (A => B)
- Contrapositive (Not B => Not A)
- Induction (First + Hypotesis and Step)
- Contradiction (Assume that B holds)
- Computational
- Construction
- Finite proof
- Obvious
- Short
- Long
- Technical
- Cited

Structure

- Logical structure
  - Outline the steps first
  - Step by step
  - Tell the reader where you are in the proof
    - First, second, finally
  - Sum up main steps
  - Point the reader to the key ingredient in each step
- Explain calculations with words
- Add detail
- Add citations and credit the sources!
- End with a symbol
  - Q.E.D. (quod erat demonstrandum)
  - Square

Useful phrases in a proof

From Higham's Handbook of Writing for the Mathematical Sciences

Structure

The aim/idea is to…
Our first goal is to show that…
The trick of the proof is to find…
The essential observation is that…

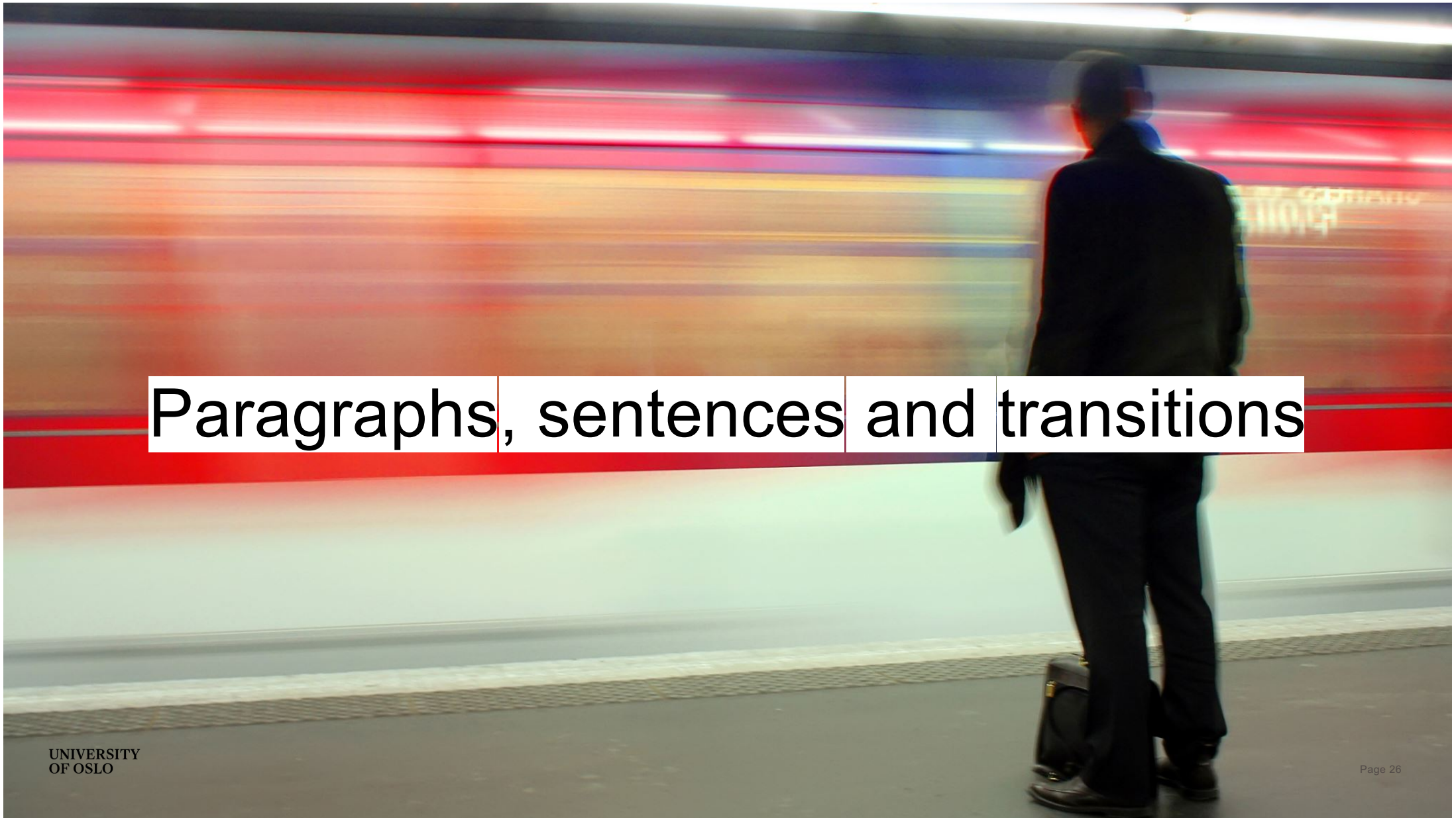
Placeholders

First, we establish that…
Our task is now to…
Our problem reduces to…
It remains to show that…
Finally, we have to show that…
We are almost ready to invoke…

Avoid phrases like

Some tedious manipulation yields…
The result follows after straightforward computations.
An obvious induction gives…
It is easy to see that…

NB! Easy must be easy for your reader, too!


Paragraphs, sentences and transitions

How to build a paragraph

A paragraph consists of three things

- Claim
- Argument
  - Examples
  - Discussion
- Conclusion
  - Say that the claim is verified!
- And these must be connected

Transitions between sentences and paragraphs

Transitional words

- Make logical transitions between sentences and paragraphs
- Many different types and subtleties
- Beware of precision level
- Keep a list of transitional words from these categories in front of you when you write text
  - Combinations
  - Implications
  - Modifications
  - Emphasis
  - Consequences

Heavily used in mathematics

- In addition to
- Furthermore
- Moreover
- Similarly
- Additionally
- First, second, third…
- Thus
- Therefore
- Consequently
- Hence
- However
- On the other hand
- In particular
- Yet
- Although
- Clearly
- Actually
- Indeed
- Obviously

Sentences

Full sentences

- Always write in full sentences
- A mathematical expression is a part of a sentence
- Never start with a mathematical symbol!
- A citation is a part of a sentence
- Beware of punctuation
  - In mathematics
  - Commas

Logical order

- The important part first (depends on context)
- Objects and properties must match

In the projective plane we show that a rational cuspidal curve can have at most four cusps

We show that four is the maximum number of cusps on a rational cuspidal plane curve

We show that a rational cuspidal curve in the projective plane can have at most four cusps

Words and abbreviations

- Write it out
  - It is, can not, do not
- Use abbreviations correctly
  - i.e. means complete list of examples or explanation
  - e.g. means incomplete list of examples
  - etc. means and so on
    - Never combine with e.g.
  - cf. means confer (compare)
  - See means find more information

- “Wicked which”
  - That defines and restricts
  - Which informs and does not restrict
- False “if”
  - “If” should be followed by “then”.


From draft to final
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Proof reading is essential

- Come to the peer review days **February 18th and May 6th**
- READ YOUR DRAFT OUT LOUD!
- Use Lee's Checklist: https://web.cs.ucdavis.edu/~amenta/w10/writingman.pdf

Proof reading details

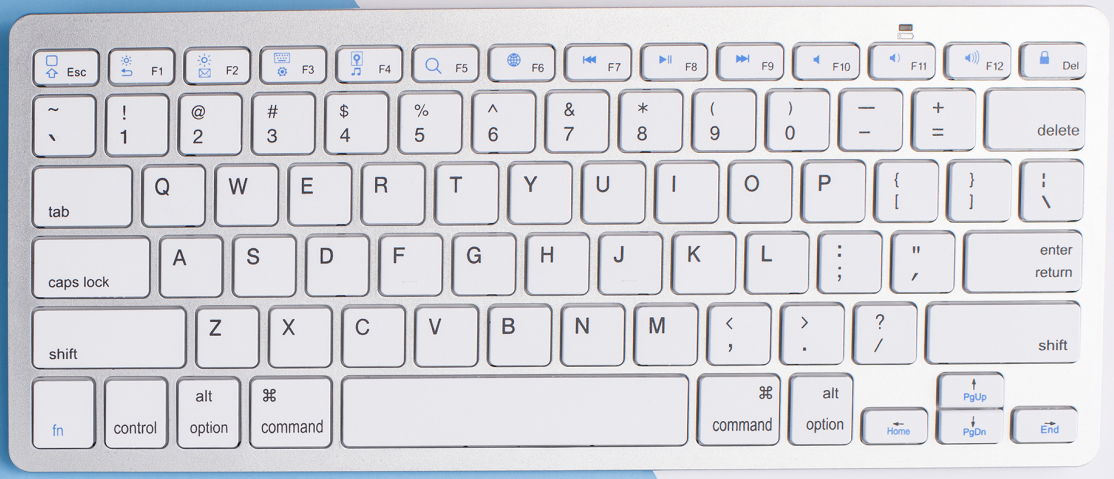
- Ensure flow between paragraphs and sections
- Beware of words repeating themselves
- Extra words and mistakes after rewrites

- Use a spell checker
- Not picked up by the spell checker
  - to or too or two
  - flaw or flow
  - plain or plane
  - Punctuation
  - Mathematics

Proof reading more than text

- Mathematics
  - Formulas
  - Indexes
  - Variables in text
  - Punctuation
- Notation
  - No unnecessary symbols
  - All symbols are defined
- Other environments
  - Table of contents
  - The reference list
  - Figures
  - Labels and cross references
- Layout
- Option FINAL in documentclass




Esc
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
Del
delete
tab
caps lock
enter
return
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command
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End

LaTeX