## A LATEX Tutorial

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# Why LATEX?

- Best way to typeset mathematics (vastly better than MS-Word)
- Most popular typesetting system among computer scientists
- Can be used to produce beautiful output

## How to use IAT<sub>E</sub>X?

- 1. Create hw1.tex with your favorite text editor.
- 2. Compile: pdflatex hw1.tex
  This produces hw1.pdf.
- 3. View: acroread hw1.pdf

## How to use IAT<sub>E</sub>X?

- 1. Create hw1.tex with your favorite text editor.
- 2. Compile: pdflatex hwl.tex
  This produces hwl.pdf.
- 3. Fix syntax errors, and go back to step 2.
- 4. View: acroread hw1.pdf
- 5. Fix typesetting errors, and go back to step 2.

## Sample document

\documentclass{article}

\begin{document}

Hello, world!

\end{document}

Input:

Output: Hello, world!

## Sample document

From here on in, I'll omit the \documentclass{...},
\begin{document} and \end{document}. Thus:

Input: Hello, world!

Output: Hello, world!

## Paragraphs

```
Line breaks in latex source
are irrelevant, except that
blank lines indicate the start
of a new paragraph.
```

```
See how this
```

```
works?
```

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### Commands

Commands use a backslash. Arguments are indicated with curly braces.

Let's try some \emph{italized} text.

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Let's try some *italized* text.

### **Mathematics**

In-line mathematics is enclosed within dollar signs.

3-2=1 looks better than 3-2=1.

12x+5 > y looks better than 12x+5 > y.

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3-2 = 1 looks better than 3-2=1.

12x + 5 > y looks better than 12x + 5; y.

### **Superscripts**

Squaring:  $x^2$ . Higher powers:  $x^n$ . Or:  $(2n+1)^3 = 8n^3 + 12n^2 + 6n + 1$ .

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Warning: If you have more than one character in the exponent, you must use curly braces for grouping. Correct: \$x^{2n}\$. Wrong: \$x^2n\$.

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### **Subscripts**

```
Index: $x_i$ and $2x_i + 1$.
Beware: curly braces needed for grouping,
as before.
Correct: $x_{2j+1}$. Wrong: $x_2j+1$.
```

Index:  $x_i$  and  $2x_i + 1$ .

Beware: curly braces needed for grouping, as before. Correct:  $x_{2j+1}$ . Wrong:  $x_2j+1$ .

## Equations

$$1 + 1 = 2. \ x \neq y.$$
  
5 < 6. 5 \le 7. 5 \ge 0.  
x \in S. y \notin S. S \le T.

Logic

 $\neg P. \ P \lor Q. \ R \land S.$  $T \implies U. \ P \lor P \equiv P.$ I claim that  $\forall x \in S.P(x)$ . Moreover,  $\exists x \in S.Q(x)$ .

### Some examples

Consider any integer n>2. Then the equation  $x^n + y^n = z^n$ has no solutions for x,y,z in the integers.

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### Some examples

Define f(1) = 1, f(n) = f(3n+1) if n is odd, and f(n) = f(n/2) if n is even. Collatz conjectured that f(n)always terminates and returns 1.

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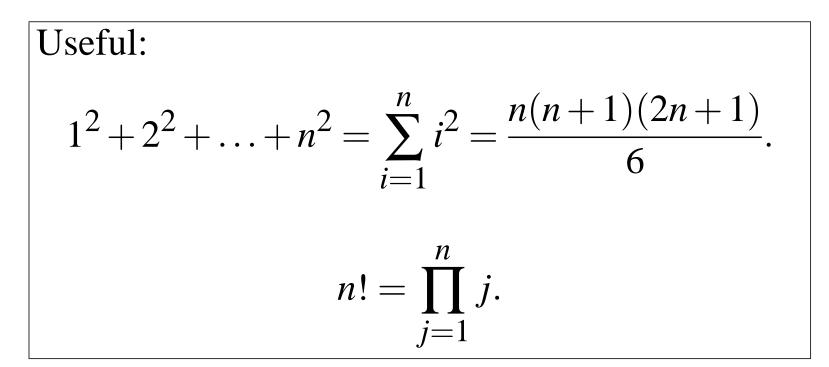
## **Displayed equations**

Sometimes you want an equation on its own line, like this:  $(x-3)^2 \ge 0.$ 

Sometimes you want an equation on its own line, like this:

 $(x-3)^2 \ge 0.$ 

#### Sums, products, and fractions



### Environments

```
\begin{quote}
```

Q: How many Stanford students does it take

```
to screw in a light bulb?
```

```
A: One, dude.
```

```
end{quote}
```

Q: How many Stanford students does it take to screw in a light bulb?

A: One, dude.

### Environments

```
\begin{verbatim}
```

Q: How many professors does it take to screw in a light bulb?

A: Only one, but they get three tech. reports out of it.

 $\end{verbatim}$ 

Q: How many professors does it take to screw in a light bulb? A: Only one, but they get three tech. reports out of it.

### Environments

```
\begin{center}
Q: How many slides does it take
until we get to a joke that is
actually funny?
A: $\infty$.
\end{center}
```

Q: How many slides does it take until we get to a joke that is actually funny?

A: ∞.

#### Lists

```
How do you catch a blue elephant?
\begin{itemize}
\item With a blue elephant net, of course.
\item But it better be an awfully big net.
\end{itemize}
```

How do you catch a blue elephant?

- Use a blue elephant net, of course.
- But it better be an awfully big net.

### Numbered lists

How do you catch a red elephant?
\begin{enumerate}
\item Hold his nose until he turns blue.
\item Then use a blue elephant net.
\end{enumerate}

How do you catch a red elephant?

1. Hold his nose until he turns blue.

2. Then use a blue elephant net.

### **Multi-line equations**

$$(x-y)(x+y) = x^2 - y^2$$
  
=  $x^2 - 9 + 9 - y^2$   
=  $(x-3)(x+3) + (3-y)(3+y)$ 

## Equations with justifications

$$f(n) = f(n-1) + n$$
 (by defined of f)  
$$= (n-1)n/2 + n$$
 (by inductive hyp)  
$$= n(n+1)/2$$
 (simple algebra)

## Theorems and proofs

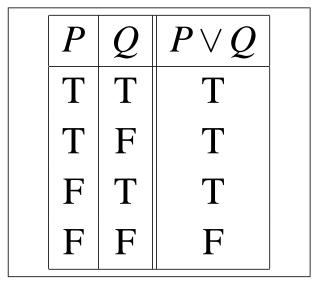
\begin{theorem} A ham sandwich is better
than good sex. \end{theorem}
\begin{proof} A ham sandwich is better
than nothing. Also, nothing is better
than good sex. The result follows by
transitivity. \end{proof}

**Theorem 1.** A ham sandwich is better than good sex.

*Proof.* A ham sandwich is better than nothing. Also, nothing is better than good sex. The result follows by transitivity.

### **Tables**

 $begin{tabular}{|c|c|c|}$ \hline \$P\$ &\$Q\$ &\$P \lor Q\$\\ \hline //T& T& T T &F &T\\  $F \& T \& T \setminus$  $F \& F \& F \setminus$ \hline  $\end{tabular}$ 



### **Pitfalls**

Many of them can be produced by prepending a backslash. For instance, 55% is produced by typing " $55\$ ", and  $\{1,2,3\}$  by " $\$\$   $\{1,2,3\$  by " $\$\$ .

### Error messages

Since  $x^2=1$ , we know x=1 or x=-1.

Type "h" for help, then "x" to exit. Next, go look at line 25 of the source document.  $\[AT_EX\]$  is telling you that there is a "\$" missing somewhere near there.

### Summary

#### LATEX is cool stuff. Give it a try.

We'll have resources posted on the web page.

And ask us if you have questions.