Introduction to Beamer

Beamer is a LaTeX class for creating slides for presentations

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What is Beamer?!

Beamer is a LaTeX class for creating presentations. It can also be used to create transparency slides. Preparing presentations with Beamer is different from preparing them with WYSWYG programs like PowerPoint. A Beamer presentation is created like any other LaTeX document: It has a preamble and a body, the body can contain sections and subsections, the different slides (called frames in Beamer) can structured using itemize and enumerate environments, and so on. The obvious disadvantage of this approach is that you have to know LaTeX in order to use Beamer. The advantage is that if you know LaTeX, you can use your knowledge of LaTeX also when creating a presentation, not only when writing papers.

How to Get Beamer

1. Update to the latest version of MixTeX (v. 2.9).
2. Download/install the COMPLETE MixTeX system.
3. PDF/LaTeX a sample document to test it out.

Commands for Header and the Title Page

```
\documentclass[xcolor=dvipsnames]{beamer}
\usecolortheme[named=BurntOrange]
\usetheme{PaloAlto}
\title[]{}
\subtitle[]{}
\author[]{}
\institute[]{}
\date{}
\begin{document}
\begin{frame}
\titlepage
\end{frame}
```

General Set-up for a Slide

```
\begin{frame}[fragile]
\frametitle{Title of slide}
content of slide
definitions
equations
pictures
\end{frame}
```

Itemize vs. Enumerate

An itemized/bulleted list:

- itemized item 1
- itemized item 2
- itemized item 3

Same structure for "enumerate" to produce a numbered list.

```
\begin{itemize}
\pause
  \item itemized item 1
\pause
  \item itemized item 2
\pause
  \item itemized item 3
\end{itemize}
```

Another Way to Create Pauses

- Normal LaTeX class.
- Easy overlays.
- No external programs needed.

```
\begin{itemize}
\item<3-> Normal LaTeX class.
\item<2-> Easy overlays.
\item<1-> No external programs needed.
\end{itemize}
```

Theorems and Such

Definition

A triangle that has a right angle is called a *right triangle*.

Theorem

In a right triangle, the square of hypotenuse equals the sum of squares of two other sides.

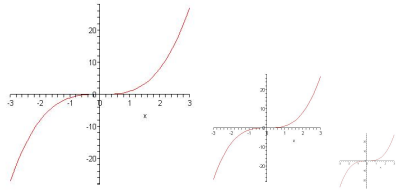
Proof.

We leave the proof as an exercise to our astute reader. We also suggest that the reader generalize the proof to non-Euclidean geometries. □

`\begin{definition} or theorem or proof`

Graphics

Here we include three images, one each of PDF, PNG, and JPG types.



Sample code:

```
\includegraphics[width=0.1\textwidth]{picture.jpg}
```

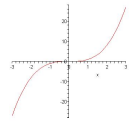

Dividing a Slide into Columns

Good for displaying equations on one side and a picture on the other.

Here is the first column.

$$f(x) = 2x^3 - 7x + 3$$

Second column with picture.



Use `\begin{columns}` with corresponding end for the columns environment.
Use `\begin{column}` with corresponding end to make the individual columns.

Dividing a Slide into Columns–Code

```
\begin{columns}
  \begin{column}{0.5\textwidth}
    Here is the first column.
    $$ f(x) = 2x^3 -7x +3 $$
  \end{column}
\pause
  \begin{column}{0.3\textwidth}
    Second column with picture.
    \centerline{\includegraphics[width=0.7\textwidth]{picture.png}}
  \end{column}
\end{columns}
\bigskip
```


A Simple Displayed Equation

A displayed formula:

$$\int_{-\infty}^{\infty} e^{-x^2}\,dx = \sqrt{\pi}$$

Code:

```
$$ \int_{-\infty}^\infty
  e^{-x^2} \, dx = \sqrt{\pi}$$
```

Array Environment-More Complex Displayed Equation

This sample uses the array environment, with $$ to create the display. Not labeled/numbered (Raynor):

$$\left\{\begin{array}{rlll} -\Delta v & = \chi_{\overline B} & & \forall x \in \Omega\\ v & =0& & \forall x \in \partial\Omega. \end{array}\right.$$

Code:

```
$$
\left\{
\begin{array}{rlll}
-\Delta v & = \chi_{\overline B} & & \forall
x \in \Omega\\
v & =0& & \forall x \in \partial\Omega.
\end{array}
\right.
$$
```

Equation Environment with a Label

Here is the previous example using the equation environment to get a label. It produces one label for both equations, which is convenient much of the time (Raynor):

$$\left\{\begin{array}{rlll} -\Delta v & = \chi_{\overline B} & & \forall x \in \Omega\\ v & =0& & \forall x \in \partial\Omega. \end{array}\right. \tag{1}$$

Code:

```
\begin{equation}
\left\{
\begin{array}{rlll}
-\Delta v & = \chi_{\overline B} & & \forall x \in \Omega\\
  v & =0& & \forall x \in \partial\Omega.
\end{array}
\right.
```

Equation Array - Labeled

The eqnarray environment environment, like many equation display environments, has two versions. "eqnarray" creates a multiline displayed equation with labels (Raynor).

$$\begin{aligned} \vec{\tilde{e}}_4 &= \vec{e}_4 - \frac{\langle \vec{e}_1, \vec{e}_3 \rangle}{\|\vec{e}_1\|^2} \vec{e}_2 && (2)\\ &= \begin{bmatrix} \tilde{\beta} \\ 0 \end{bmatrix}, && (3) \end{aligned}$$

```
\begin{eqnarray} % note use of vectors
\vec{\tilde{e}}_4 & = & \vec{e}_4-
\frac{\langle \vec{e}_1, \vec{e}_3 \rangle}{\|\vec{e}_1\|^2} \vec{e}_2 \\
& = & \begin{bmatrix}
\tilde{\beta} \\0
\end{bmatrix},
```

eqnarray* - No Labels

"eqnarray*" creates a multiline displayed equation with no labels (Raynor):

$$\begin{aligned} \vec{\tilde{e}}_4 &= \vec{e}_4 - \frac{\langle \vec{e}_1, \vec{e}_3 \rangle}{\|\vec{e}_1\|^2} \vec{e}_2\\ &= \begin{bmatrix} \tilde{\beta} \\ 0 \end{bmatrix}. \end{aligned}$$

```
\begin{eqnarray*}
\vec{\tilde{e}}_4 & = & \vec{e}_4- \frac{\langle \vec{e}_1, \vec{e}
& = & \begin{bmatrix}
\tilde{\beta} \\
0
\end{bmatrix}.
\end{eqnarray*}
```

Equation Array with Pauses

$$\begin{aligned} 2x^2 + 3(x-1)(x-2) &= 2x^2 + 3(x^2 - 3x + 2) \\ &= 2x^2 + 3x^2 - 9x + 6 \\ &= 5x^2 - 9x + 6 \end{aligned}$$

```
\begin{eqnarray*}
2x^2 + 3(x-1)(x-2)&=&2x^2 + 3(x^2-3x+2)\\
\pause &=& 2x^2 + 3x^2 - 9x + 6\\
\pause &=& 5x^2 - 9x + 6
\end{eqnarray*}
```

Case Definitions

Used when a definition have two or more cases. Use the case statement.

$$f(x) = \begin{cases} 1 & -1 \le x < 0 \\ \frac{1}{2} & x = 0 \\ 1 - x^2 & \text{otherwise} \end{cases}$$

The code for the above example:

```
f(x) =
\begin{cases}
1           & -1 \le x < 0 \\
\frac{1}{2} & x = 0 \\
1 - x^2     & \mbox{otherwise}
\end{cases}
```

Align Environment - Unstarred and Starred

The advantage of the align environment is that you can force multiple parts of each line to align correctly vertically, making pretty multipart sets of equations (Raynor):

$$\frac{\partial u_i}{\partial t} + \sum_{j=1}^{n} u_j \frac{\partial u_1}{\partial x_j} = \nu \Delta u_i - \frac{\partial p}{\partial x_i} + f_i(x,t) \quad x \in \mathbb{R}^n, t \geq 0 \quad (4)$$

$$\nabla \cdot \vec{u} = 0 \quad x \in \mathbb{R}^n, t \geq 0 \quad (5)$$

$$\vec{u}(x,0) = \vec{u}_0(x) \quad x \in \mathbb{R}^n, \quad (6)$$

```
\begin{align} % or align* for the unlabeled version
\frac{\partial u_i}{\partial t} + \sum_{j=1}^n u_j \frac{\partial u_1}{\par
\nabla \cdot \vec{u} & = 0 & & x \in \mathbb{R}^n, t \geq 0 \\
\vec{u}(x,0) & = \vec{u}_0 (x) & & x \in \mathbb{R}^n,
\end{align}
```

A Matrix Using the Array Environment

The equation environment is used to display a single equation with a tag (Raynor):

$$J\mathcal{H}(\omega)|_{D_\omega} = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & a(\omega) & 0 \end{pmatrix}, \quad (7)$$

```
\begin{equation}% equation* for no label
J\mathcal{H}(\omega)|_{D_\omega}= \left(
\begin{array}{cccc}
0 & 1 & 0 & 0\\
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 \\
0 & 0 & a(\omega)& 0
\end{array} \right)\label{jhomega},
```

Inline Matrix

And matrices can also be created inline with text, as such: $\begin{pmatrix} u \\ v \end{pmatrix}$.
(This sample uses the pmatrix environment.) (Raynor)

Matrix Types

```
\begin{matrix} x & y \\ z & v \end{matrix}
```

$$\begin{matrix} x & y \\ z & v \end{matrix}$$

```
\begin{vmatrix} x & y \\ z & v \end{vmatrix}
```

$$\begin{vmatrix} x & y \\ z & v \end{vmatrix}$$

```
\begin{Vmatrix} x & y \\ z & v \end{Vmatrix}
```

$$\begin{Vmatrix} x & y \\ z & v \end{Vmatrix}$$

More Matrix Types

```
\begin{bmatrix} x & y \\ z & v \end{bmatrix}
```

$$\begin{bmatrix} x & y \\ z & v \end{bmatrix}$$

```
\begin{Bmatrix} x & y \\ z & v \end{Bmatrix}
```

$$\begin{Bmatrix} x & y \\ z & v \end{Bmatrix}$$

```
\begin{pmatrix} x & y \\ z & v \end{pmatrix}
```

$$\begin{pmatrix} x & y \\ z & v \end{pmatrix}$$

A matrix expression

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \times \begin{bmatrix} y_1 \\ y_2 \end{bmatrix}$$

Code:

```
$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} =
\begin{bmatrix} A & B \\ C & D \end{bmatrix} \times
\begin{bmatrix} y_1 \\ y_2 \end{bmatrix}$$
```

Another matrix example

$$\begin{bmatrix} 0 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & 0 \end{bmatrix}$$

Code:

```
$$ \begin{bmatrix} 0 & \cdots & 0 \\
   \vdots & \ddots & \vdots \\
   0 & \cdots & 0 \end{bmatrix} $$
```

Handouts

```
\documentclass[xcolor=dvipsnames,handout]{beamer}
\usepackage{pgfpages}
\pgfpagesuselayout{4 on 1}[border shrink=5mm]
```

"handout" gets rid of the pauses
The other commands produce 4 slides per page.

URL's

A regular URL:
http://www.math.wfu.edu/
A URL with text other than the web address:
WFU MATH

```
\usepackage{hyperref}  (might not be needed)
\textcolor{DarkOrchid}{\url{http://www.math.wfu.edu/}}
\textcolor{red}{\href{http://www.math.wfu.edu}{WFU MATH}}
```

For Later Reference

http://www.wfu.edu/~wickersg/latex/index.html

- Color palate that can be used in Beamer
- Beamer Themes
- Beamer Quick Start Guide
- Posters
- Thesis style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