

# Introduction to Beamer

Beamer is a LaTeX class for creating slides for presentations

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# How to Get Beamer

- Go to <http://latex-beamer.sourceforge.net/>
- Just Google "Beamer" – Should be the 1st link.
- Copy the all the code between and including the begin and end document commands and paste it into a new document in WinEdt.
- PDF/LaTeX the document
- You will have to install FOUR packages as the document processes. This will take some time.

# 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:

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- itemized item 1

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



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

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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

- No external programs needed.

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

# Theorems and Such

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## Definition

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



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## Theorem

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## Theorem

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

## Proof.

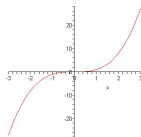
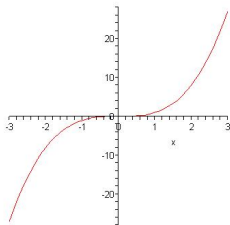
We leave the proof as an exercise to our astute reader. We also suggest that the reader generalize the proof to non-Euclidean geometries. □

`\begin{definition}` or theorem or proof



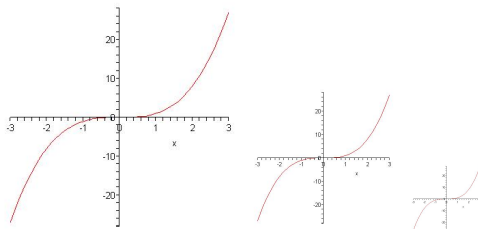
# Graphics

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



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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.

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

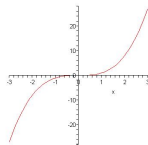
# Dividing a Slide into Columns

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.



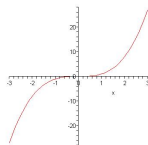
## Dividing a Slide into Columns

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}}
  \end{column}
\end{columns}
\bigskip

```



# A Simple Displayed Equation

A displayed formula:

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

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

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):

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

## Array Environment-More Complex Displayed Equation

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

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

Code:

```

$$
\left\{
\begin{array}{rll}
-\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):

$$\begin{cases} -\Delta v &= \chi_{\overline{B}} & \forall x \in \Omega \\ v &= 0 & \forall x \in \partial\Omega. \end{cases} \quad (1)$$

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Code:

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

## Equation Array - Labeled

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

$$\vec{e}_4 = \vec{e}_4 - \frac{\langle \vec{e}_1, \vec{e}_3 \rangle}{\|\vec{e}_1\|^2} \vec{e}_2 \quad (2)$$

$$= \begin{bmatrix} \tilde{\beta} \\ 0 \end{bmatrix}, \quad (3)$$

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$$= \begin{bmatrix} \tilde{\beta} \\ 0 \end{bmatrix}, \quad (3)$$

```
\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},
\end{eqnarray}
```



## eqnarray\* - No Labels

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

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

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

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

# Equation Array with Pauses

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

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

# Equation Array with Pauses

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

## 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.

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

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

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):

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

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

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

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

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

```
\begin{align} % or align* for the unlabeled version
\frac{\partial u_i}{\partial t} + \sum_{j=1}^n u_j \frac{\partial u_1}{\partial x_j} &= \nu \Delta u_i - \frac{\partial p}{\partial x_i} + f_i(x, t) & x \in \mathbb{R}^n, t \geq 0 & (4) \\
\nabla \cdot \vec{u} &= 0 & x \in \mathbb{R}^n, t \geq 0 & (5) \\
\vec{u}(x, 0) &= \vec{u}_0(x) & x \in \mathbb{R}^n, & (6) \\
\end{align}
```

## A Matrix Using the Array Environment

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

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

# A Matrix Using the Array Environment

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```
\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

# Matrix Types

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

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

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

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

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

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



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```
\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

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

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

# 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}
```

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

## 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

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

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

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

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



# 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]
```

# URL's

`http://www.math.wfu.edu/`

## URL's

```
http://www.math.wfu.edu/
```

```
\usepackage{hyperref}
```

```
\textcolor{DarkOrchid}{\url{http://www.math.wfu.edu/}}
```

# For Later Reference

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

- Color palate that can be used in Beamer
- Beamer Themes
- Another reference for Beamer Themes
- Beamer Quick Start

