

MATH 3341: Introduction to Scientific Computing Lab

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Lab 01: Introduction to MATLAB and \LaTeX



MATLAB Interface

The screenshot shows the MATLAB R2016b interface. The main window is divided into several panes:

- File Explorer:** Located on the left, showing the current folder structure. A red box highlights this pane, with a red arrow pointing to the label "File Explorer".
- Editor:** The central pane for editing code. A blue box highlights this pane, with a blue arrow pointing to the label "Editor".
- Workspace:** Located on the right, showing the current workspace variables. A green box highlights this pane, with a green arrow pointing to the label "Workspace".
- Command Window:** Located at the bottom, showing the command prompt. An orange box highlights this pane, with an orange arrow pointing to the label "Command Window".

The Command Window shows the following output:

```
>> addition  
C =  
3  
>>
```

The Workspace pane shows the following variables:

Name	Value
a	1
b	2
c	3

Command Window

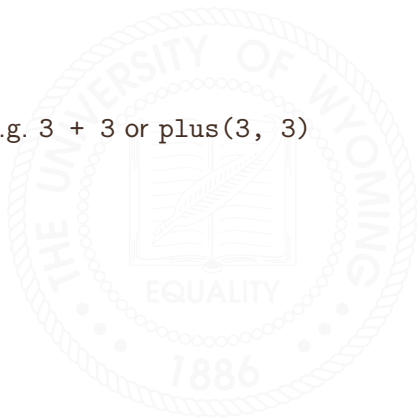




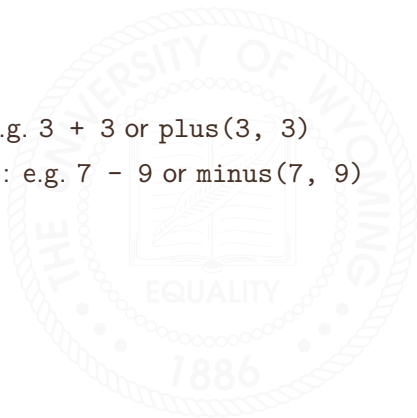
Basic Math Operations



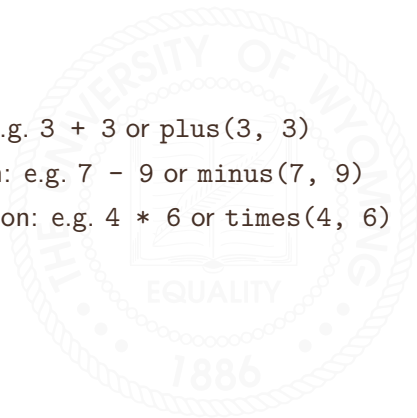
- Addition: e.g. $3 + 3$ or `plus(3, 3)`



- Addition: e.g. $3 + 3$ or `plus(3, 3)`
- Subtraction: e.g. $7 - 9$ or `minus(7, 9)`



- Addition: e.g. $3 + 3$ or plus(3, 3)
- Subtraction: e.g. $7 - 9$ or minus(7, 9)
- Multiplication: e.g. $4 * 6$ or times(4, 6)




- Addition: e.g. $3 + 3$ or `plus(3, 3)`
- Subtraction: e.g. $7 - 9$ or `minus(7, 9)`
- Multiplication: e.g. $4 * 6$ or `times(4, 6)`
- Division: e.g. $6 / 3$ or `rdivide(6, 3)`



- Addition: e.g. $3 + 3$ or `plus(3, 3)`
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- Multiplication: e.g. $4 * 6$ or `times(4, 6)`
- Division: e.g. $6 / 3$ or `rdivide(6, 3)`
- Exponentiation: e.g. $2 ^ 3$ or `power(2, 3)`





Exponential and Natural Logarithm Functions



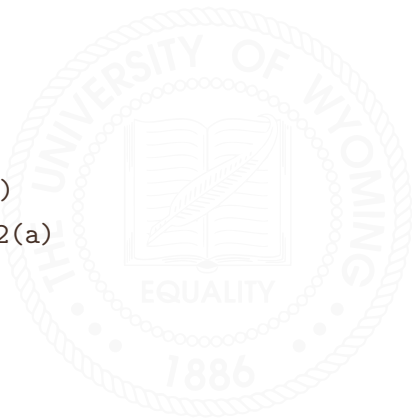
- e^x : `exp(x)`



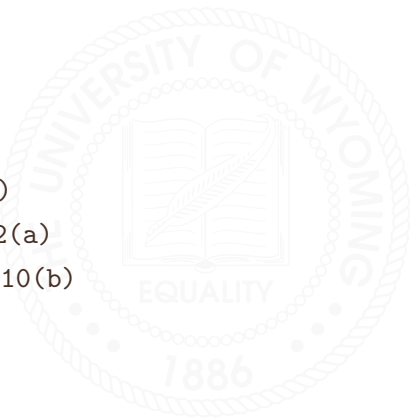
- e^x : `exp(x)`
- $\ln y$: `log(y)`



- e^x : `exp(x)`
- $\ln y$: `log(y)`
- $\log_2 a$: `log2(a)`



- e^x : `exp(x)`
- $\ln y$: `log(y)`
- $\log_2 a$: `log2(a)`
- $\log_{10} b$: `log10(b)`

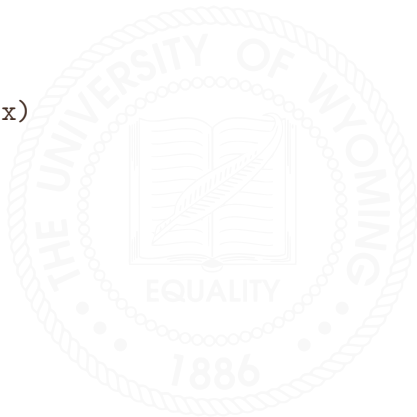




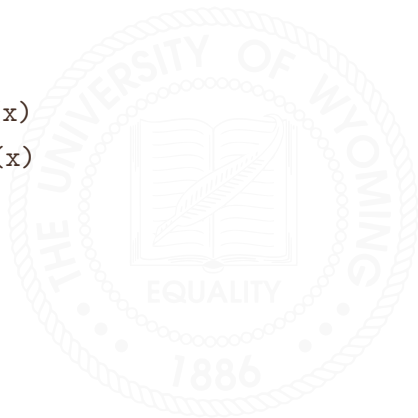
Trigonometric Functions



- $\sin x$: `sin(x)`



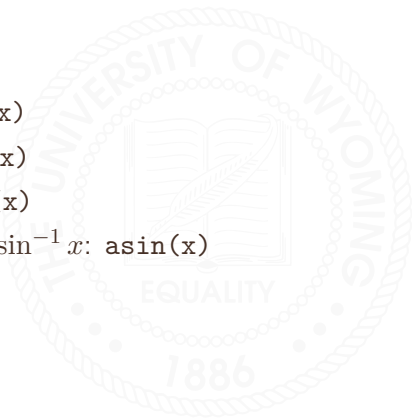
- $\sin x$: `sin(x)`
- $\cos x$: `cos(x)`



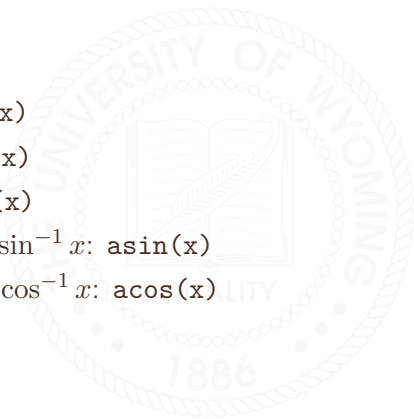
- $\sin x$: `sin(x)`
- $\cos x$: `cos(x)`
- $\tan x$: `tan(x)`



- $\sin x$: `sin(x)`
- $\cos x$: `cos(x)`
- $\tan x$: `tan(x)`
- $\arcsin x$ or $\sin^{-1} x$: `asin(x)`



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- $\arcsin x$ or $\sin^{-1} x$: `asin(x)`
- $\arccos x$ or $\cos^{-1} x$: `acos(x)`



- $\sin x$: `sin(x)`
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- $\tan x$: `tan(x)`
- $\arcsin x$ or $\sin^{-1} x$: `asin(x)`
- $\arccos x$ or $\cos^{-1} x$: `acos(x)`
- $\arctan x$ or $\tan^{-1} x$: `atan(x)`





Functions Commonly Used



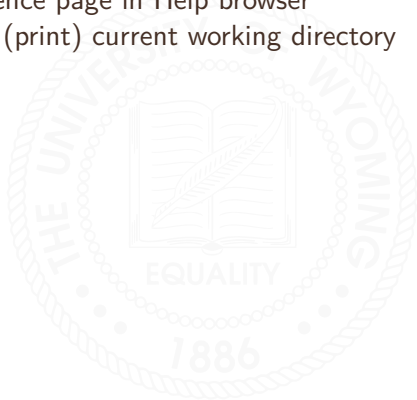
- `help`: Display help text in Command Window



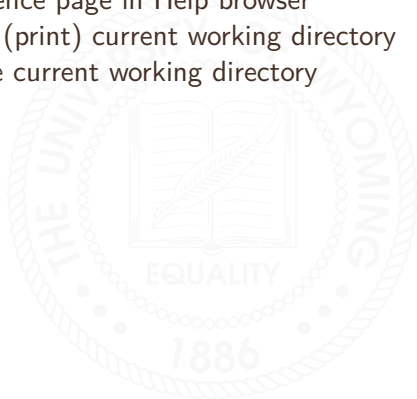
- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser



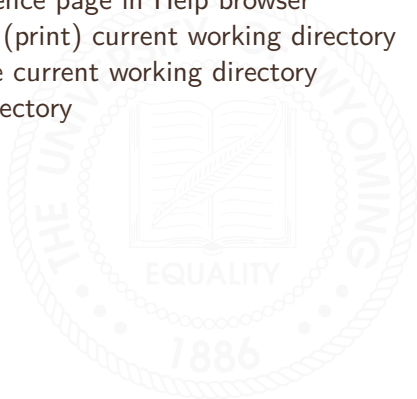
- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser
- `pwd`: Show (print) current working directory



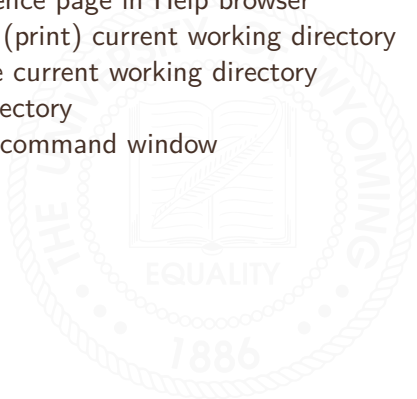
- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser
- `pwd`: Show (print) current working directory
- `cd`: Change current working directory



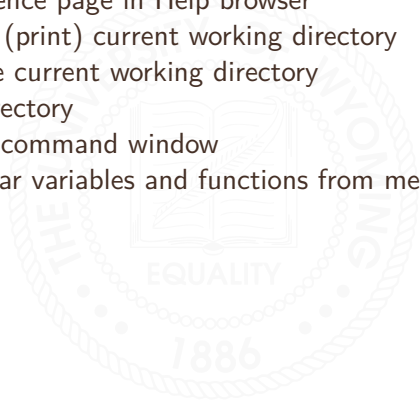
- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser
- `pwd`: Show (print) current working directory
- `cd`: Change current working directory
- `ls`: List directory



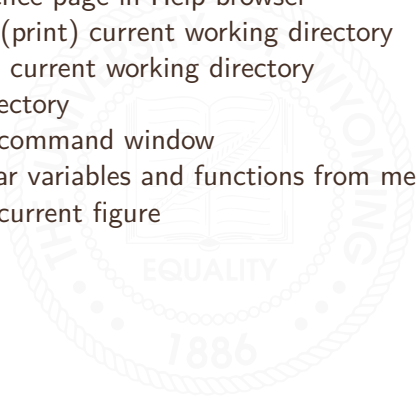
- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser
- `pwd`: Show (print) current working directory
- `cd`: Change current working directory
- `ls`: List directory
- `clc`: Clear command window



- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser
- `pwd`: Show (print) current working directory
- `cd`: Change current working directory
- `ls`: List directory
- `clc`: Clear command window
- `clear`: Clear variables and functions from memory



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- `clf`: Clear current figure



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- `beep off/on`: turns off/on noise produced by error messages



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- `clear`: Clear variables and functions from memory
- `clf`: Clear current figure
- `beep off/on`: turns off/on noise produced by error messages
- `diary`: Save text of MATLAB session



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- `pwd`: Show (print) current working directory
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- `clc`: Clear command window
- `clear`: Clear variables and functions from memory
- `clf`: Clear current figure
- `beep off/on`: turns off/on noise produced by error messages
- `diary`: Save text of MATLAB session
- `realmin`: Smallest positive normalized floating point number



- `help`: Display help text in Command Window
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- `pwd`: Show (print) current working directory
- `cd`: Change current working directory
- `ls`: List directory
- `clc`: Clear command window
- `clear`: Clear variables and functions from memory
- `clf`: Clear current figure
- `beep off/on`: turns off/on noise produced by error messages
- `diary`: Save text of MATLAB session
- `realmin`: Smallest positive normalized floating point number
- `realmax`: Largest finite floating point number



- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser
- `pwd`: Show (print) current working directory
- `cd`: Change current working directory
- `ls`: List directory
- `clc`: Clear command window
- `clear`: Clear variables and functions from memory
- `clf`: Clear current figure
- `beep off/on`: turns off/on noise produced by error messages
- `diary`: Save text of MATLAB session
- `realmin`: Smallest positive normalized floating point number
- `realmax`: Largest finite floating point number
- `intmin`: Smallest integer value



- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser
- `pwd`: Show (print) current working directory
- `cd`: Change current working directory
- `ls`: List directory
- `clc`: Clear command window
- `clear`: Clear variables and functions from memory
- `clf`: Clear current figure
- `beep off/on`: turns off/on noise produced by error messages
- `diary`: Save text of MATLAB session
- `realmin`: Smallest positive normalized floating point number
- `realmax`: Largest finite floating point number
- `intmin`: Smallest integer value
- `intmax`: Largest positive integer value



- `help`: Display help text in Command Window
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- `pwd`: Show (print) current working directory
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- `clc`: Clear command window
- `clear`: Clear variables and functions from memory
- `clf`: Clear current figure
- `beep off/on`: turns off/on noise produced by error messages
- `diary`: Save text of MATLAB session
- `realmin`: Smallest positive normalized floating point number
- `realmax`: Largest finite floating point number
- `intmin`: Smallest integer value
- `intmax`: Largest positive integer value
- `eps`: Spacing of floating point numbers



- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser
- `pwd`: Show (print) current working directory
- `cd`: Change current working directory
- `ls`: List directory
- `clc`: Clear command window
- `clear`: Clear variables and functions from memory
- `clf`: Clear current figure
- `beep off/on`: turns off/on noise produced by error messages
- `diary`: Save text of MATLAB session
- `realmin`: Smallest positive normalized floating point number
- `realmax`: Largest finite floating point number
- `intmin`: Smallest integer value
- `intmax`: Largest positive integer value
- `eps`: Spacing of floating point numbers
- `class`: Return class name of object





\LaTeX Primer



Basic structure

```
\documentclass{article}
\usepackage{amssmb, amsmath}
\author{firstName lastName}
\title{The Title}
\date{\today}
\begin{document}
\maketitle
\section{Demo of Section}
\subsection{Demo of Subsection}
Here is the body.
\end{document}
```

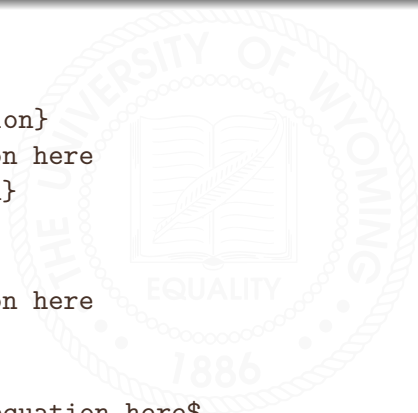


Math Environment/Mode

```
\begin{equation}  
% Put equation here  
\end{equation}
```

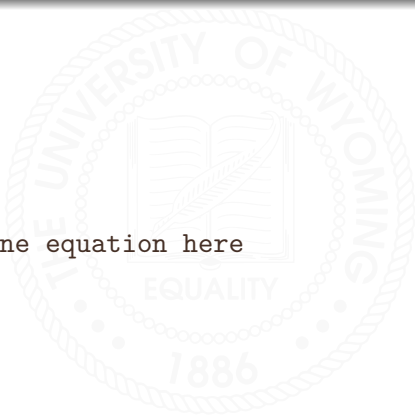
```
$$  
% Put equation here  
$$
```

```
$Put inline equation here$
```



Multi-line equations

```
\begin{align}  
% Put multiline equation here  
\end{align}
```



Examples

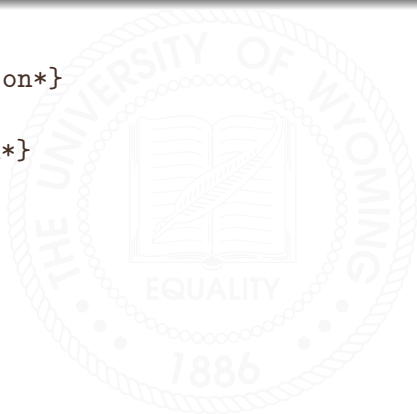
```
\begin{equation*}  
E = mc^2.  
\end{equation*}
```

or

```
$$  
E = mc^2.  
$$
```

generates

$$E = mc^2.$$



Examples

```
\begin{align}
  \frac{d}{dx} f(g(x))
    &= \frac{d f(g(x))}{d g(x)} \frac{d g(x)}{dx}
  \\ &= f'(g(x)) g'(x).
\end{align}
```

generates

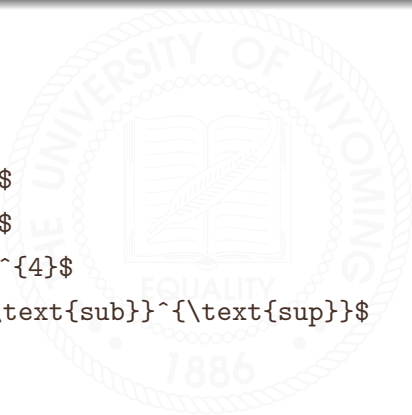
$$\frac{d}{dx} f(g(x)) = \frac{df(g(x))}{dg(x)} \frac{dg(x)}{dx} \quad (1)$$

$$= f'(g(x))g'(x). \quad (2)$$



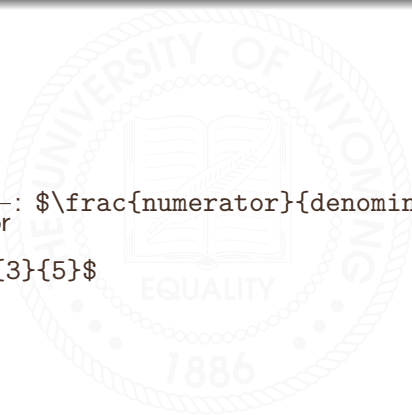
Subscripts and Superscripts

- a_1 : `a_{1}`
- a^2 : `a^{2}`
- a_3^4 : `a_{3}^{4}`
- $a_{\text{sub}}^{\text{sup}}$: `$a_{\text{\text{sub}}}^{\text{\text{sup}}}$`



Fractions

- $\frac{\text{numerator}}{\text{denominator}}$: `\frac{numerator}{denominator}`
- $\frac{3}{5}$: `\frac{3}{5}`



Matrices

```
$$  
\begin{matrix}  
a_{11} & a_{12} \\ \\\br/>a_{21} & a_{22} \\ \\\br/>\end{matrix}  
$$
```

Replace `matrix` with `bmatrix`, `pmatrix`, `vmatrix`, `Vmatrix`, respectively.

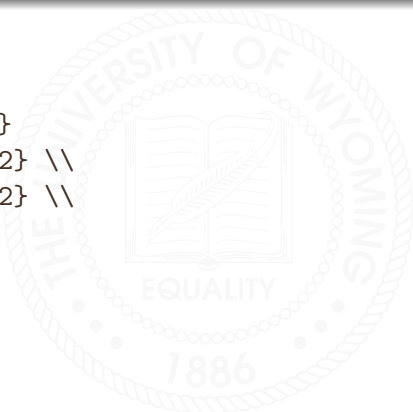


matrix environment

```
$$  
\begin{matrix}  
a_{11} & a_{12} \\ a_{21} & a_{22} \\ \end{matrix}  
$$
```

generates

$$\begin{matrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{matrix}$$



bmatrix environment

```
$$  
\begin{bmatrix}  
a_{11} & a_{12} \\ \\\br/>a_{21} & a_{22} \\ \\\br/>\end{bmatrix}  
$$
```

generates

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$$



pmatrix environment

```
$$  
\begin{pmatrix}  
a_{11} & a_{12} \\  
a_{21} & a_{22} \\  
\end{pmatrix}  
$$
```

generates

$$\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}$$



vmatrix environment

```
$$  
\begin{vmatrix}  
a_{11} & a_{12} \\ \\\br/>a_{21} & a_{22} \\ \\\br/>\end{vmatrix}  
$$
```

generates

$$\begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}$$



Vmatrix environment

```
$$  
\begin{Vmatrix}  
a_{11} & a_{12} \\ \\  
a_{21} & a_{22} \\ \\  
\end{Vmatrix}  
$$
```

generates

$$\left\| \begin{array}{cc} a_{11} & a_{12} \\ a_{21} & a_{22} \end{array} \right\|$$

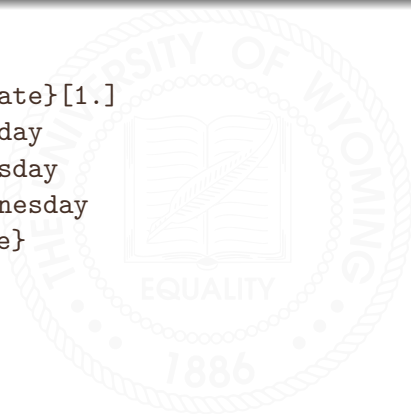


enumerate Environment

```
\begin{enumerate}[1.]  
  \item Monday  
  \item Tuesday  
  \item Wednesday  
\end{enumerate}
```

generates

1. Monday
2. Tuesday
3. Wednesday

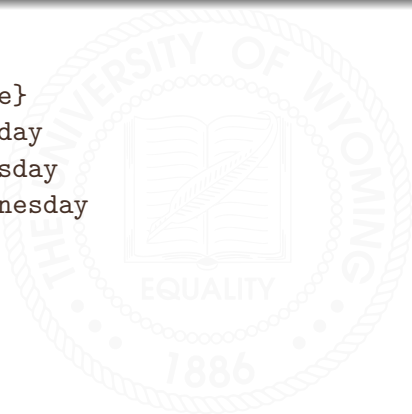


itemize Environment

```
\begin{itemize}
  \item Monday
  \item Tuesday
  \item Wednesday
\end{itemize}
```

generates

- Monday
- Tuesday
- Wednesday



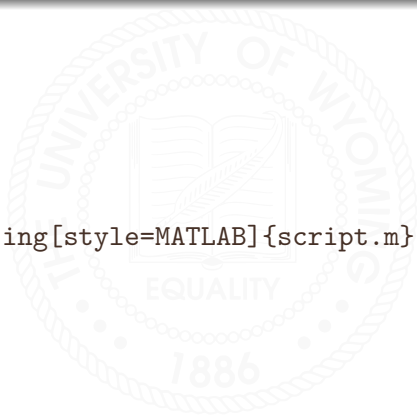
lstlisting Environment

```
\begin{lstlisting}[style=MATLAB]
clear; clc;
x = linspace(0, 2 * pi, 100);
y = sin(x);
figure
plot(x, y)
xlabel('$x$')
ylabel('$y$')
title('$y = \sin\{x\}$')
\end{lstlisting}
```



lstlisting Environment

```
\lstinputlisting[style=MATLAB]{script.m}
```



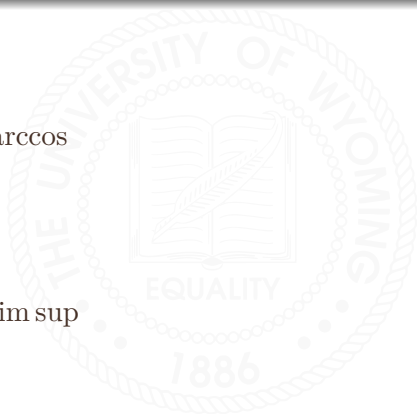
Greek Letters

- `\alpha`: α
- `\beta`: β
- `\gamma`: γ
- `\rho`: ρ
- `\phi`: ϕ
- `\varphi`: φ
- \vdots



Standard Function Names

- `\cos`: `cos`
- `\arccos`: `arccos`
- `\dim`: `dim`
- `\log`: `log`
- `\ln`: `ln`
- `\limsup`: `lim sup`
- `\min`: `min`
- `\deg`: `deg`
- `\operatorname{span}`: `span`



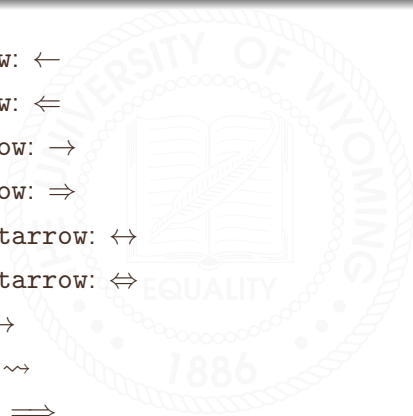
Binary Operation/Relation Symbols

- `\pm`: \pm
- `\oplus`: \oplus
- `\perp`: \perp
- `\subset`: \subset
- `\in`: \in
- `\leq`: \leq
- `\geq`: \geq
- `\neq`: \neq



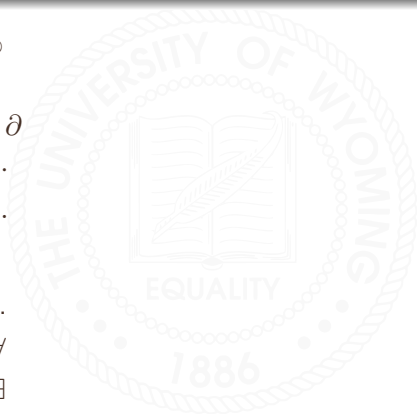
Arrow Symbols

- `\leftarrow`: \leftarrow
- `\Leftrightarrow`: \Leftrightarrow
- `\rightarrow`: \rightarrow
- `\Rightarrow`: \Rightarrow
- `\leftrightarrow`: \leftrightarrow
- `\Leftrightarrow`: \Leftrightarrow
- `\mapsto`: \mapsto
- `\leadsto`: \leadsto
- `\implies`: \implies
- `\impliedby`: \impliedby
- `\iff`: \iff



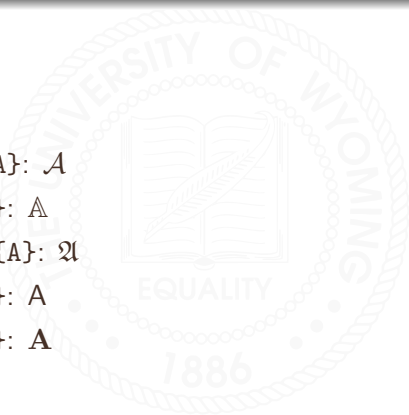
Miscellaneous Symbols

- `\infty`: ∞
- `\nabla`: ∇
- `\partial`: ∂
- `\cdots`: \dots
- `\ldots`: \dots
- `\vdots`: \vdots
- `\ddots`: \ddots
- `\forall`: \forall
- `\exists`: \exists
- `\emptyset`: \emptyset
- `\int`: \int
- `\iint`: \iint



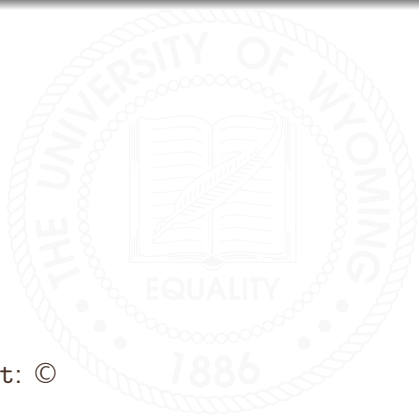
Styles

- `\mathcal{A}`: \mathcal{A}
- `\mathbb{A}`: \mathbb{A}
- `\mathfrak{A}`: \mathfrak{A}
- `\mathsf{A}`: A
- `\mathbf{A}`: \mathbf{A}



Text Mode: Accents and Symbols

- `\'o`: ó
- `\.o`: ò
- `\b{o}`: o̲
- `\o`: ø
- `\ae`: æ
- `\"o`: ö
- `\copyright`: ©
- `\S`: §



Text formatting

- `\textit{Italic}`: *Italic*
- `\textsc{Small Caps}`: SMALL CAPS
- `\textsl{Slanted}`: *Slanted*
- `\textup{Upright}`: Upright
- `\textbf{Boldface}`: **Boldface**
- `\textmd{Medium}`: Medium
- `\texttt{TypeWriter}`: TypeWriter
- `\textsf{Sans Serif}`: Sans Serif
- `\textrm{Roman}`: Roman

