

MATH 3341: Introduction to Scientific Computing Lab

Libao Jin

University of Wyoming

January 29, 2020

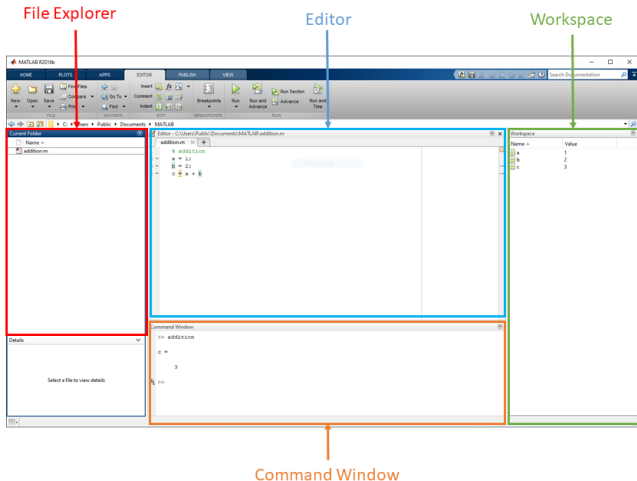




Lab 01: Introduction to MATLAB and \LaTeX



MATLAB Interface



Command Window

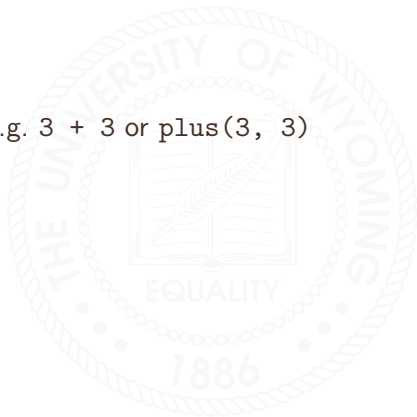




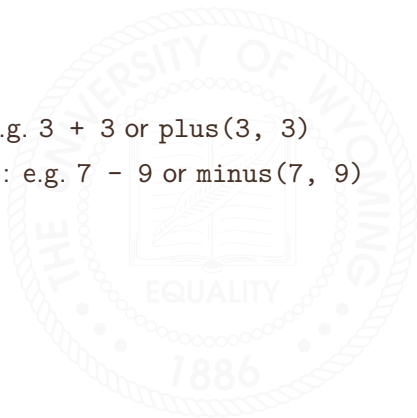
Basic Math Operations



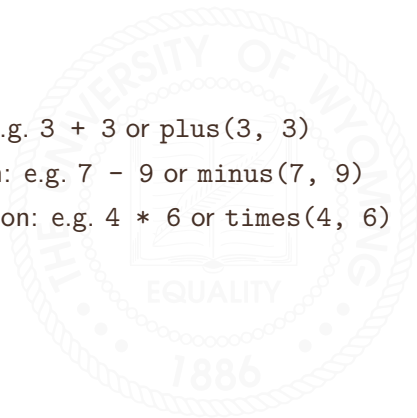
- Addition: e.g. $3 + 3$ or `plus(3, 3)`



- 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)`
- 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)`
- Exponentiation: e.g. $2 ^ 3$ or `power(2, 3)`





Exponential and Natural Logarithm Functions



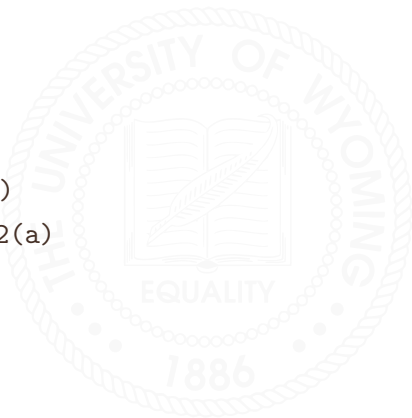
- e^x : `exp(x)`



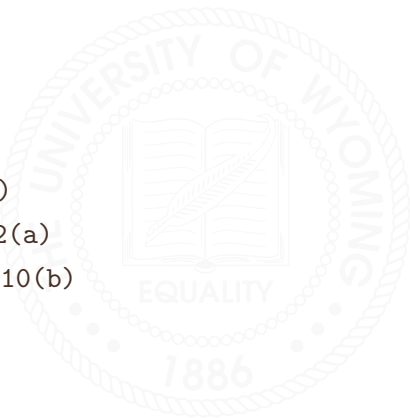
- e^x : `exp(x)`
- $\ln y$: `log(y)`



- 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)`

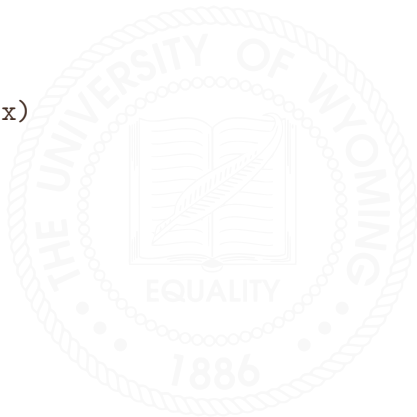




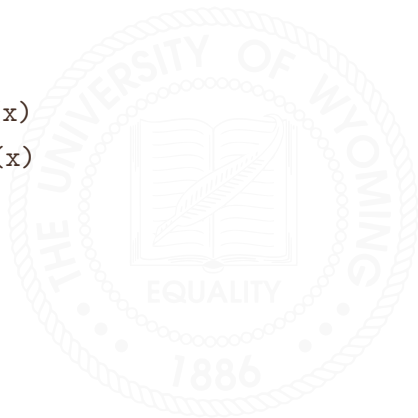
Trigonometric Functions



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



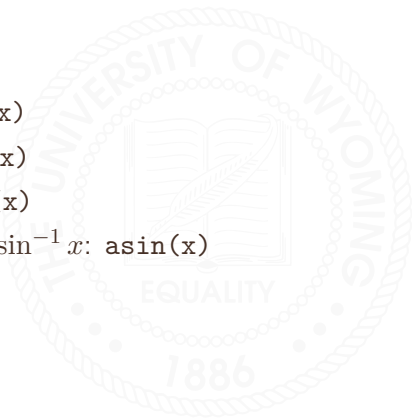
- $\sin x$: `sin(x)`
- $\cos x$: `cos(x)`



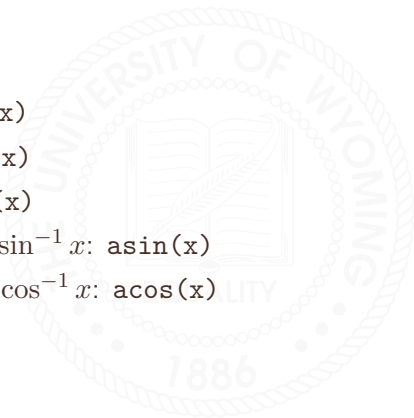
- $\sin x$: `sin(x)`
- $\cos x$: `cos(x)`
- $\tan x$: `tan(x)`



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



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



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



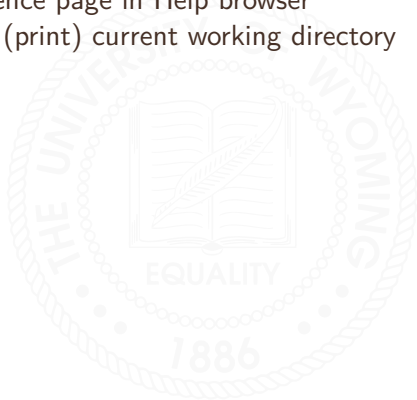
- `help`: Display help text in Command Window



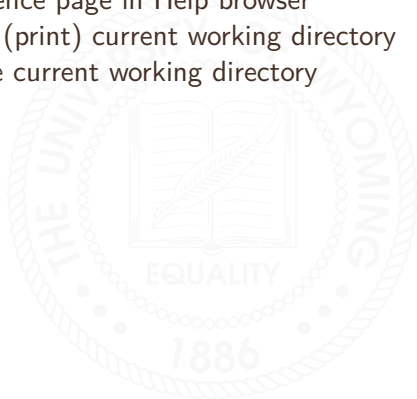
- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser



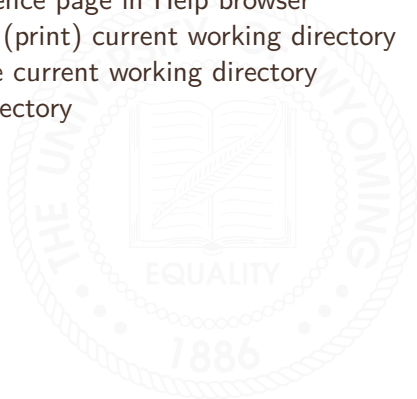
- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser
- `pwd`: Show (print) current working directory



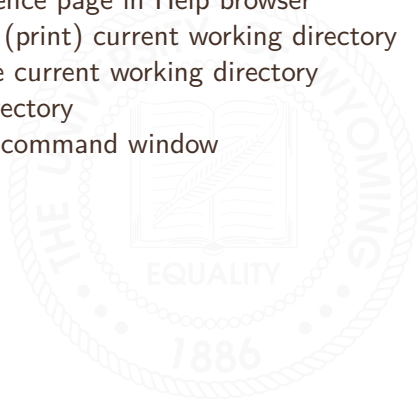
- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser
- `pwd`: Show (print) current working directory
- `cd`: Change current working directory



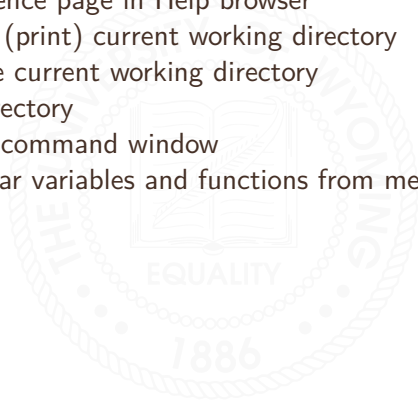
- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser
- `pwd`: Show (print) current working directory
- `cd`: Change current working directory
- `ls`: List directory



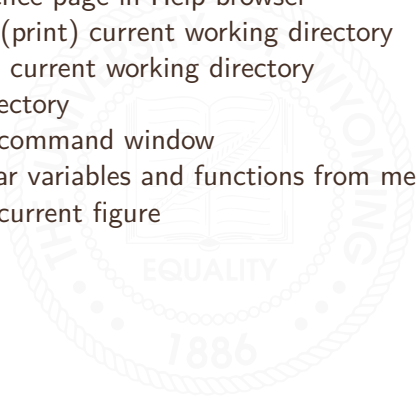
- `help`: Display help text in Command Window
- `doc`: Reference page in Help browser
- `pwd`: Show (print) current working directory
- `cd`: Change current working directory
- `ls`: List directory
- `clc`: Clear command window



- `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



- `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



- `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



- `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



- `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



- `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



- `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
- `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



- `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}
```

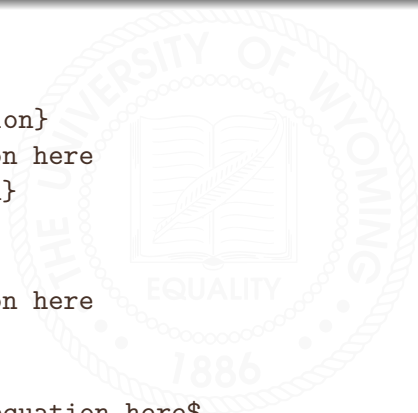


Math Environment/Mode

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

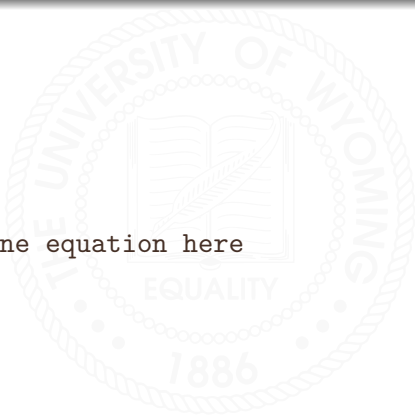
```
$$  
% Put equation here  
$$
```

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



Multi-line equations

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



Examples

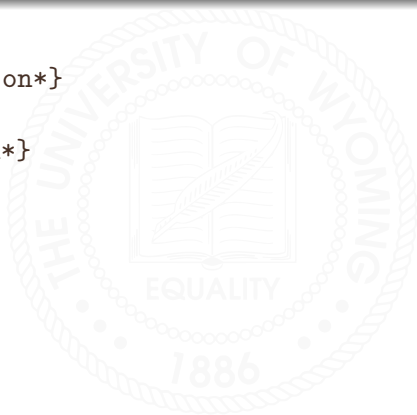
```
\begin{equation*}  
E = mc^2.  
\end{equation*}
```

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

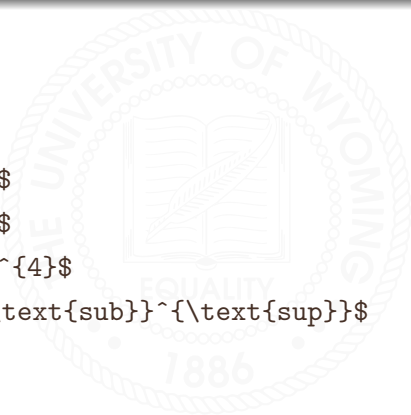
$$\frac{d}{dx} f(g(x)) = \frac{df(g(x))}{dg(x)} \frac{dg(x)}{dx} \quad (1)$$

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



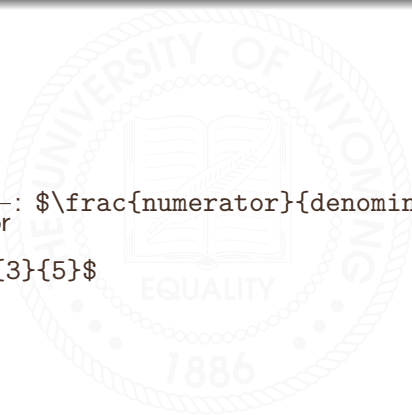
Subscripts and Superscripts

- 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.

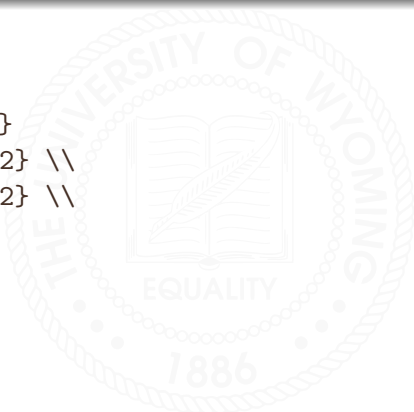


matrix environment

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

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

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

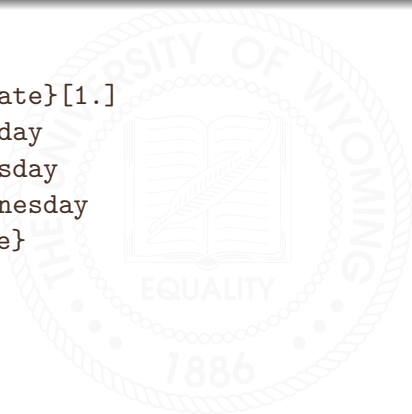


enumerate Environment

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

generates

1. Monday
2. Tuesday
3. Wednesday

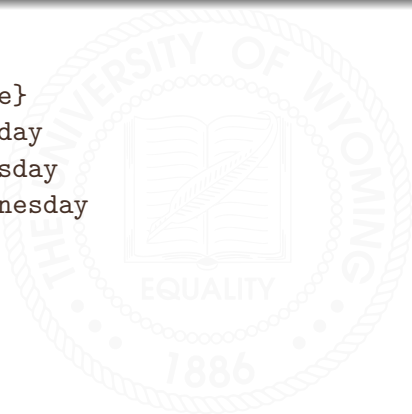


itemize Environment

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

generates

- Monday
- Tuesday
- Wednesday



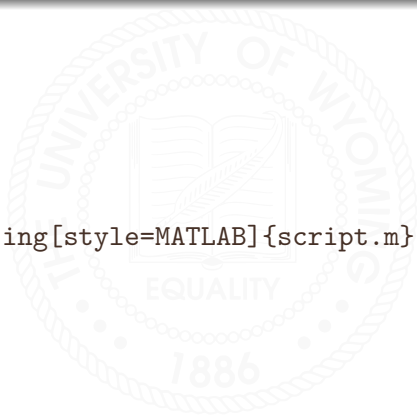
lstlisting Environment

```
\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}
```



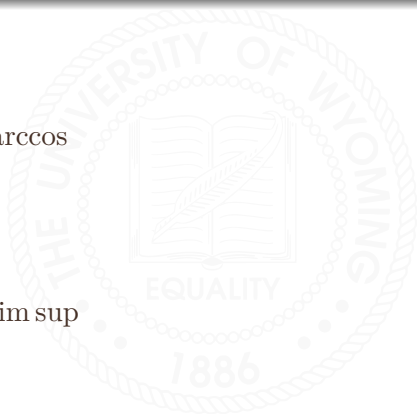
Greek Letters

- `\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`



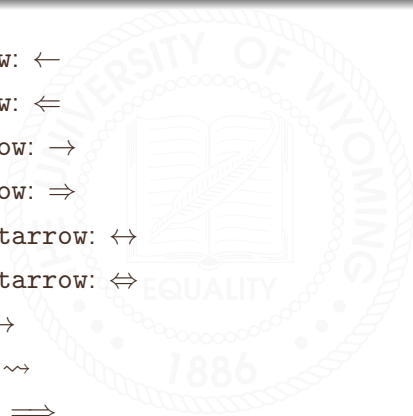
Binary Operation/Relation Symbols

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



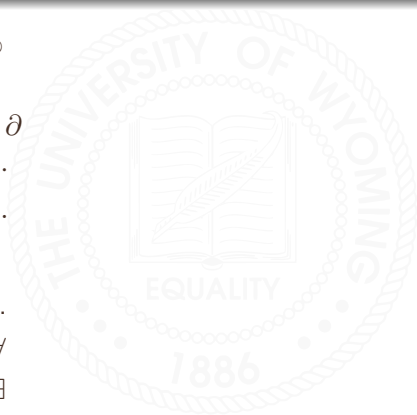
Arrow Symbols

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



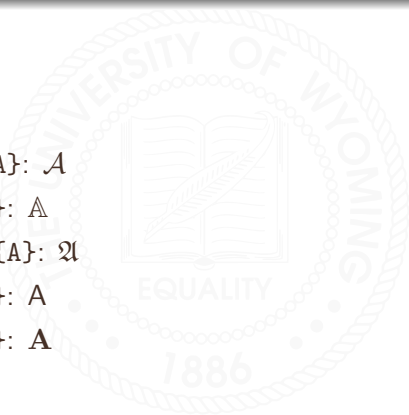
Miscellaneous Symbols

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



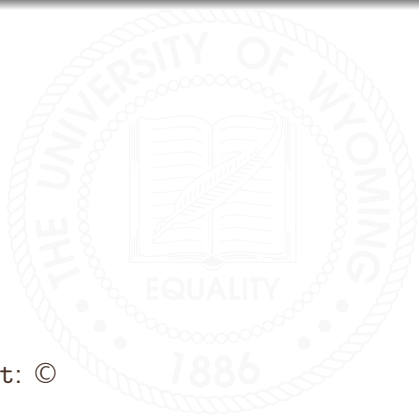
Styles

- `\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

