LaTeX

PHSG SEM 3 AND 5

PAPER : SEC A1

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Presentation #7 12-01-2024

TWO-SIDED DOCUMENTS

- DOCUMENTS CAN BE ONE-SIDED OR TWO-SIDED.
- ARTICLES ARE BY DEFAULT ONE-SIDED.
- BOOKS ARE BY DEFAULT TWO-SIDED.
- TWO-SIDED DOCUMENTS DIFFERENTIATE THE LEFT (EVEN) AND RIGHT (ODD) PAGES.
- IF YOU WANT TO MAKE THE ARTICLE CLASS TWO-SIDED, USE

\documentclass[twoside]{article}

PAGE SIZE

- THE DEFAULT PAGE SIZE FOR ALL STANDARD DOCUMENT CLASSES IS US LETTER.
- FOR A4 FORMAT:

```
\documentclass[a4paper]{article}
```

geometry AND *hyperref* PACKAGES

- THE IMMEDIATE ADVANTAGE OF THE GEOMETRY PACKAGE IS THAT IT LETS YOU CUSTOMIZE THE PAGE SIZE.
- TO SET THE PAGE SIZE, ADD THE FOLLOWING TO YOUR PREAMBLE:

\usepackage[a4paper]{geometry}

- The geometry package has many pre-defined page sizes,
  - *a0paper, a1paper, ..., a6paper,*
  - *b0paper, b1paper, ..., b6paper,*
  - *letterpaper,*
  - *legalpaper,*
  - *executivepaper.*

amsmath AND *mathtools* PACKAGE

- IF YOU NEED A FEW SIMPLE MATHEMATICAL FORMULAS, PLAIN LATEX HAS MOST OF THE TOOLS THAT YOU WILL NEED.
- IF YOU ARE WRITING A SCIENTIFIC DOCUMENT THAT CONTAINS NUMEROUS COMPLICATED FORMULAS, THE ***amsmath*** PACKAGE INTRODUCES SEVERAL NEW COMMANDS THAT ARE MORE POWERFUL AND FLEXIBLE THAN THE ONES PROVIDED BY LATEX.
- THE ***mathtools*** PACKAGE FIXES SOME ***amsmath*** ISSUES AND ADDS SOME USEFUL SETTINGS, SYMBOLS, AND ENVIRONMENTS TO ***amsmath***.
- TO USE EITHER PACKAGE, INCLUDE THE FOLLOWING IN THE PREAMBLE OF THE DOCUMENT:

  ***usepackage{amsmath}**

  OR

  ***usepackage{mathtools}**
- THE ***mathtools*** PACKAGE LOADS THE ***amsmath*** PACKAGE.
- IN MATHEMATICAL EXPRESSIONS, THE VARIABLES ARE IN ITALICS AND IN DIFFERENT FONT THAN NORMAL TEXT.

MATHEMATICAL OPERATORS

- AN OPERATOR IS A FUNCTION THAT IS WRITTEN AS A WORD.
- E.G. : TRIGONOMETRIC FUNCTIONS (SIN, COS, TAN), LOGARITHMS AND EXPONENTIALS (LOG, EXP), LIMITS (LIM), AS WELL AS TRACE AND DETERMINANT (TR, DET).

EXAMPLES OF OPERATORS

```
\documentclass{article}

        \begin{document}

        $\cos (2\theta)$ = $\cos^2 \Theta $ -
        $\sin^2 \theta$\\

        $\lim_{x \to \infty} \exp(-x) = 0$\\

        $\hbar$

\end{document}
```

$$\cos(2\theta) = \cos^2 \Theta \text{ - } \sin^2 \theta$$
$$\lim_{x \to \infty} \exp(-x) = 0$$
$$\hbar$$

POWERS AND INDICES

- POWERS AND INDICES ARE EQUIVALENT TO SUPERSCRIPTS AND SUBSCRIPTS IN NORMAL TEXT MODE.
- THE CARET (^) CHARACTER IS USED TO RAISE SOMETHING.
- THE UNDERSCORE (_) IS FOR LOWERING.
- IF MORE THAN ONE EXPRESSION IS RAISED OR LOWERED, THEY SHOULD BE GROUPED USING CURLY BRACES { AND }.
- FOR POWERS WITH MORE THAN ONE DIGIT, SURROUND THE POWER WITH {}.

EXAMPLES OF POWERS AND INDICES

```
\documentclass{article}
\begin{document}
        $k_{n+1} = n^2 + k_n^2 - k_{n-1}$\\
        $n^{22}$\\
        $f(n) = n^5 + 4n^2 + 2 _{n=17}$
\end{document}
```

$$k_{n+1} = n^2 + k_n^2 - k_{n-1}$$

$$n^{22}$$

$$f(n) = n^5 + 4n^2 + 2_{n=17}$$

FRACTIONS

- A FRACTION IS CREATED USING THE ***\frac{numerator}{denominator}*** COMMAND.
- YOU CAN EMBED FRACTIONS WITHIN FRACTIONS:

  $\frac{\frac{1}{x}+\frac{1}{y}}{y-z}$
- ANOTHER WAY TO WRITE FRACTIONS IS TO USE THE ***\over*** COMMAND WITHOUT THE ***amsmath*** PACKAGE:

  ${n! \over k!(n-k)!}$

$$\frac{\frac{1}{x}+\frac{1}{y}}{y-z}$$

$$\frac{n!}{k!(n-k)!}$$

EXAMPLES

```
\documentclass{article}
\usepackage{amsmath}
\begin{document}
        ${}^3/_7$\\
        $1/x$\\
        Take ${}^1/_2$ cup of sugar, \dots\\
        $3\times{}^1/_2=1{}^1/_2$\\
         $x^\frac{1}{2}$\\
        $x^{{}^1/_2}$
\end{document}
```

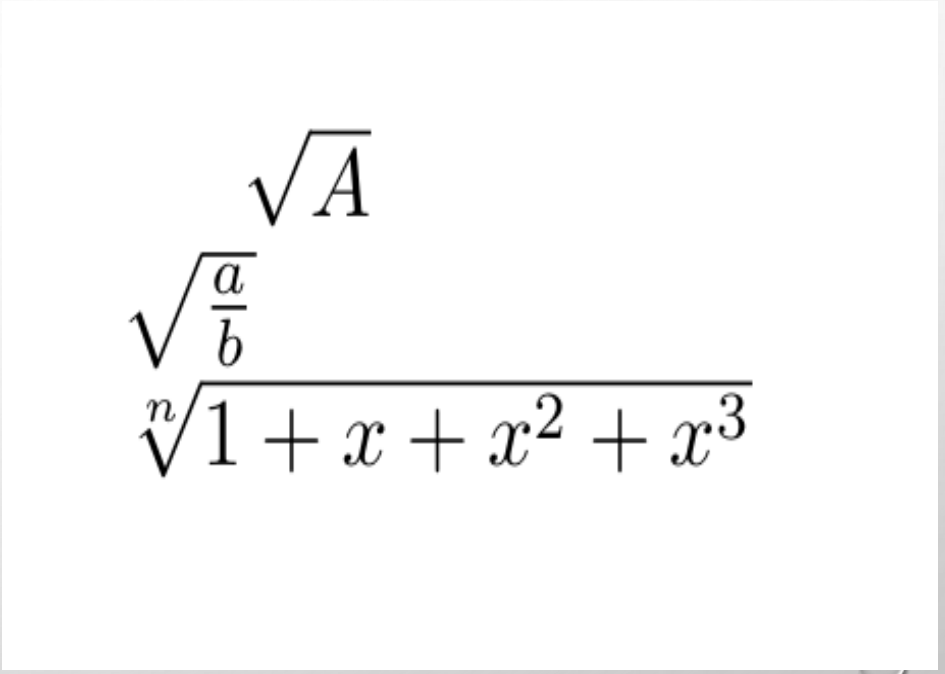
$$
\begin{array}{l}
{}^{3}/_{7} \\
1/x \\
\text{Take } {}^{1}/_{2} \text{ cup of sugar, } \dots \\
3 \times {}^{1}/_{2} = 1{}^{1}/_{2} \\
x^{\frac{1}{2}} \\
x^{{}^{1}/_{2}}
\end{array}
$$

ROOTS

- THE ***\sqrt*** COMMAND CREATES A SQUARE ROOT SURROUNDING AN EXPRESSION.
- IT ACCEPTS AN OPTIONAL ARGUMENT SPECIFIED IN SQUARE BRACKETS [AND] TO CHANGE MAGNITUDE.

- EXAMPLE:

```
\documentclass{article}
\begin{document}
        $\sqrt{A}$\\
        $\sqrt{\frac{a}{b}}$\\
        $\sqrt[n]{1+x+x^2+x^3}$
\end{document}
```



SUMS AND INTEGRALS

- THE *\sum* AND *\int* COMMANDS INSERT THE SUM AND INTEGRAL SYMBOLS RESPECTIVELY, WITH LIMITS SPECIfiED USING THE CARET (^) AND UNDERSCORE (_).

- EXAMPLE:

```
\documentclass{article}
\begin{document}
        $\sum_{i=1}^{10} t_i$\\
        $\int_0^\infty e^{-x}dx$\\
        $\int\limits_0^\infty e^{x}dx$\\
        $\int\limits_0^\infty\mathrm{e}^{x+y+z}\mathrm{d}x$\\
        $\int_0^\infty\mathrm{e}^{x+y+z}\mathrm{d}x$
\end{document}
```

$$\sum_{i=1}^{10} t_i$$

$$\int_0^\infty e^{-x}dx$$

$$\int\limits_0^\infty e^{x}dx$$

$$\int\limits_0^\infty \mathrm{e}^{-x+y+z}\mathrm{d}x$$

$$\int_0^\infty \mathrm{e}^{-x+y+z}\,\mathrm{d}x$$

EXAMPLES

```
\documentclass{article}
\usepackage{amsmath}
\begin{document}
        $\prod_i^{100} x_i$\\
        $\oint e^{-x}dx$\\
        $\iint e^{x}dxdy$\\
        $\iiint e^{-xyz}dxdydz$\\
        $\int_0^\infty\int_0^\infty e^{xy}dxdy$
\end{document}
```

$$\prod_i^{100} x_i$$
$$\oint e^{-x}dx$$
$$\iint e^{x}dxdy$$
$$\iiint e^{-xyz}dxdydz$$
$$\int_0^\infty\int_0^\infty e^{xy}dxdy$$

AUTOMATIC SIZING

- VERY OFTEN MATHEMATICAL FEATURES WILL DIFFER IN SIZE, IN WHICH CASE THE BRACKETS SURROUNDING THE EXPRESSION SHOULD VARY IN SIZE ACCORDINGLY.
- THIS CAN BE DONE AUTOMATICALLY USING THE ***\left***, ***\right***, AND ***\middle*** COMMANDS.
- EXAMPLE:

```
\documentclass{article}

        \begin{document}

        $\left(\frac{x^2}{y^3}\right)$\\

        $\left\{\frac{x^2}{y^3}\right\}$

\end{document}
```

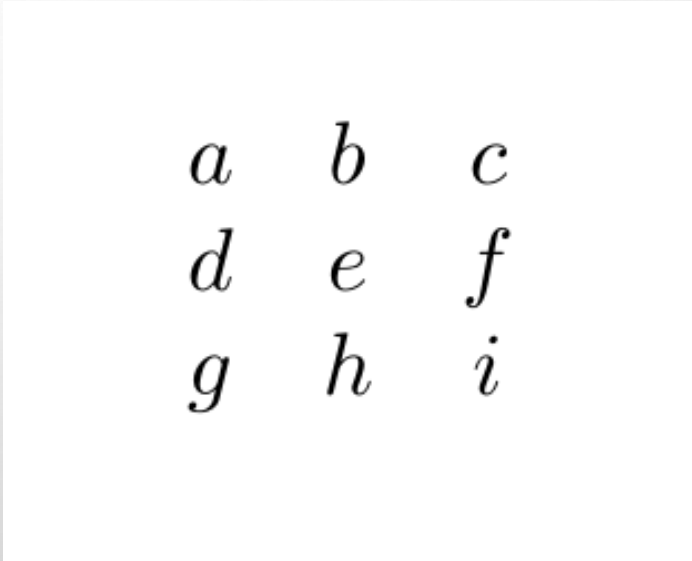
$$\left(\frac{x^2}{y^3}\right)$$

$$\left\{\frac{x^2}{y^3}\right\}$$

MATRICES AND ARRAYS

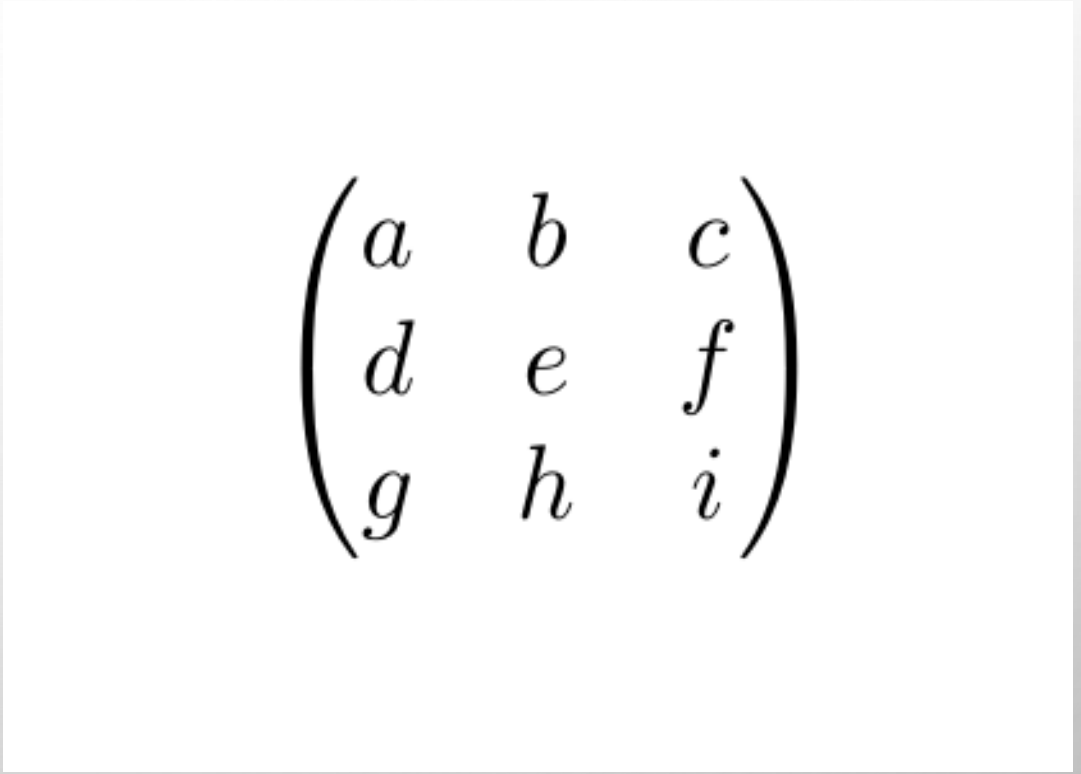
- A BASIC MATRIX MAY BE CREATED USING THE MATRIX ENVIRONMENT.
- ENTRIES ARE SPECIfiED BY ROW, WITH COLUMNS SEPARATED USING AN AMPERSAND (&) AND A NEW ROWS SEPARATED WITH A DOUBLE BACKSLASH (\\)

- ***\documentclass{article}***
- ***\usepackage{amsmath}***
- ***\begin{document}***
- ***$\begin{matrix}***
- ***a & b & c ***
- ***d & e & f ***
- ***g & h & i***
- ***\end{matrix}$***
- ***\end{document}***



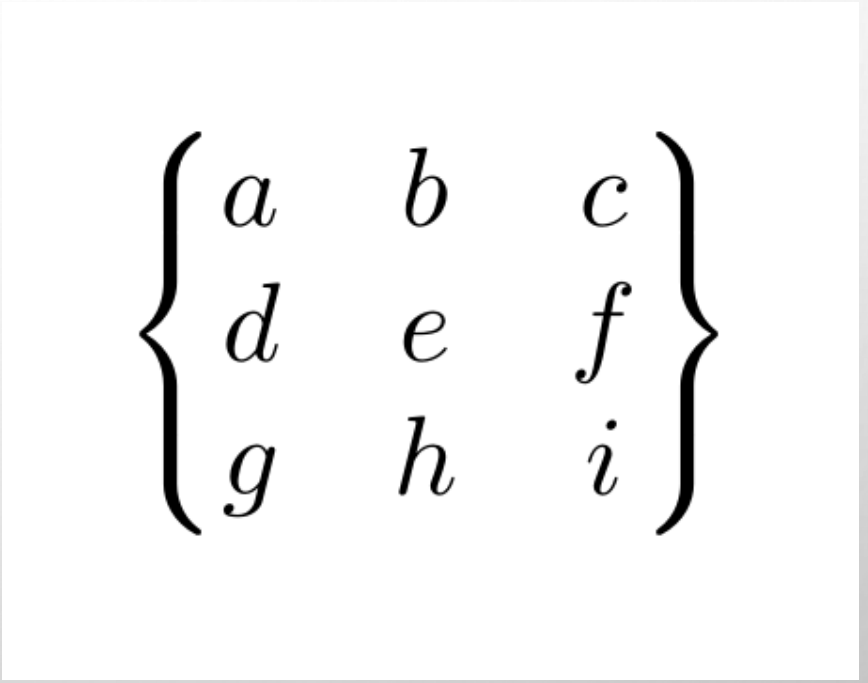
MATRICES AND ARRARYS

- \documentclass{article}
- \usepackage{amsmath}
- \begin{document}
- $\left(
- \begin{matrix}
- a & b & c \\
- d & e & f \\
- g & h & i
- \end{matrix}
- \right)$
- \end{document}



MATRICES AND ARRARYS

- \documentclass{article}
- \usepackage{amsmath}
- \begin{document}
- $\left\{
- \begin{matrix}
- a & b & c \\
- d & e & f \\
- g & h & i
- \end{matrix}
- \right\}$
- \end{document}



MATRICES AND ARRARYS

- \documentclass{article}
- \usepackage{amsmath}
- \begin{document}
- $\left[
- \begin{matrix}
- a & b & c \\
- d & e & f \\
- g & h & i
- \end{matrix}
- \right]$
- \end{document}