Math 291: Lecture 3

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- 2 Grouping Symbols
- Symbols Placed Above and Below Other Characters



Typesetting Several Equations

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Outline



2 Grouping Symbols

3 Symbols Placed Above and Below Other Characters

4 Typesetting Several Equations

Compare the following. The first in each pair is in-line math, and the second in each pair is displayed math.

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Compare the following. The first in each pair is in-line math, and the second in each pair is displayed math.

- The fraction $\frac{3}{4}$.
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Compare the following. The first in each pair is in-line math, and the second in each pair is displayed math.

- The fraction $\frac{3}{4}$.
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- The convergence of the infinite sum $\sum_{i=1}^{\infty} \frac{1}{n^p}$ is determined by the value of the parameter p.
- The convergence of the infinite sum

$$\sum_{i=1}^{\infty} \frac{1}{n^p}$$

is determined by the value of the parameter p.

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• Notice that in each pair, there are differences in the size of the expression and in the sub- and superscript locations in the typeset formulas.

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- LATEX uses \$ · · · \$ to typeset "in-line" equations.

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- LATEX uses \$ · · · \$ to typeset "in-line" equations.
- For displayed equations, there are a few options:

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- $\[Mathebaarrow ET_{EX}\]$ uses $\[Mathebaarrow \cdots\]$ to typeset "in-line" equations.
- For displayed equations, there are a few options:
 - $\$ \cdots \$$ [the default for un-numbered equations]

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- For displayed equations, there are a few options:
 - $\$ \cdots \$$ [the default for un-numbered equations]
 - \begin{displaymath} blah blah \end{displaymath}
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- Hybrid
 - \$\displaystyle blahhh... \$

[Size and sub- and superscript locations are as in displayed equations, but it is typeset in-line. See next slide.]

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The generalized intersection is $\bigcap_{i=1}^{\infty} A_i$ (displaystyle) or $\bigcap_{i=1}^{\infty} A_i$.

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• Changes to the size and sub- and superscript behavior occur in all "large symbols" such as: $\sum, \int, \bigcap, \bigcup, \bigvee$, etc.

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- Changes to only subscript behavior occur in the commands: lim, lim inf, min, max etc.
 - For example consider: $\min_{P} L(P, f)$ and $\min_{P} L(P, f)$

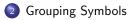
Practice Exercises:

- Type $\lim_{n\to\infty} \frac{n^2}{3n^2-2n+1} = \frac{1}{3}$ in four ways:
 - As an in-line equation (using \cdots)
 - As a displayed equation (using \$\$...\$\$)
 - As a displayed equation with line numbers (using \begin{equation}, \end{equation})
 - As an in-line equation using the \displaystyle command.

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Outline





3) Symbols Placed Above and Below Other Characters

4 Typesetting Several Equations

• Compare the form of the statements:
$$(\frac{1}{2} + \frac{1}{5})$$
 and $(\frac{1}{2} + \frac{1}{5})$.

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- Possible shapes for these commands include: () [] || [] etc.
- The compiler requires a \right for each \left, but does not require the left and right sides to have the same shape.
- If you want to have just a left or just a right, you can use the "empty" grouping symbol of \right. or \left. for the missing side.

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Practice:

• Typeset: $\left| \frac{1}{3}, 6 \right|$ • Typeset the formula: $\left(1 + \frac{1}{n} \right)^n \rightarrow e$ • Typeset the formula: $\left[\frac{1}{x} + 3x \right]_1^5 = -\frac{4}{5} + 12 = \frac{56}{5}$

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Actual Code:

- \$\$\left)\frac{1}{3},6\right[\$\$
- \$\$\left(1+\frac{1}{n}\right)^n 4\rightarrow e\$\$
- \$\$\left[\frac{1}{x}+3x\right|_1^5=-\frac{4}{5}+12=\frac{56}{5}\$\$

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Outline





Symbols Placed Above and Below Other Characters



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- Two more related symbols are \widehat{} and \widetilde{}.

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Accents

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 - Use the special commands\imath and \jmath to get the un-dotted versions. (e.g. \vec{\imath})
- Two more related symbols are \widehat{} and \widetilde{}.
- For example, we used these instead of regular hats and tildes in these expressions: \widehat{xyz} and $\widetilde{3xy}$.

• Three more common commands are: \overline{}, \underline, \underbrace{}.

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- If we include the package amsmath, we can also make use of additional commands like: \overleftarrow{}, \underleftrightarrow{}, \xrightarrow[this below]{that above} etc.
 - Recall: In Large Commands, [] indicates an optional argument, while { } indicates a required argument (empty is usually allowed).

There are several commands that allow us to place objects on top of one another.

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• Practice: Typeset $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CD} \xrightarrow{\text{vector}} \overrightarrow{AC} + \overrightarrow{CD} \stackrel{\text{simp}}{=} \overrightarrow{AD}$

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- Here is the code to do this:

\$\$\underbrace{\overrightarrow{AB}+\overrightarrow{BC}}
+\overrightarrow{CD}
\xrightarrow[\mbox{addition}]{\mbox{vector}}
\overrightarrow{AC}+\overrightarrow{CD}
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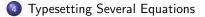
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Outline

Display Math

2 Grouping Symbols

3) Symbols Placed Above and Below Other Characters



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- The "multline" command:
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 - Equation numbers are placed either to the left of the first line or to the right of the last line.
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- The "split" command:
 - Does not compile as if in math mode (so you can use it inside another environment such as equation or equation*).
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 - Equation numbers are vertically centered (at least by default).

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 - Line breaks are still done manually.
 - Equation numbers are vertically centered (at least by default).
 - Lines are lined up with the use of the alignment character &.

Practice: Type (with align or align*, and note the difference) \begin{align} \sin t \left(\csc t - \sin t \right) &= \sin t \left(\frac{1}{\sin t} - \sin t \right) \\ &= 1 - \sin^2 t \\ &= \cos^2 t \end{align}

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- Practice: Type (with align or align*, and note the difference) \begin{align} \sin t \left(\csc t - \sin t \right) &= \sin t \left(\frac{1}{\sin t} - \sin t \right) \\ &= 1 - \sin^2 t \\ &= \cos^2 t \end{align}
- Your output should look like (using align):

$$\sin t \left(\csc t - \sin t\right) = \sin t \left(\frac{1}{\sin t} - \sin t\right) \tag{1}$$
$$= 1 - \sin^2 t \tag{2}$$

$$=\cos^{2}t$$
 (3)

(a)

• & indicates the location in each line that should act as the alignment reference, \\ says when to end a line.

• Next, try:

```
\begin{multline}
382x^{13}+32x^{12}+x^{11}+x^{10}+x^9+x^8+x^7+321x^6\\
+x^5+19x^4+x^3+38x^2+x+1
\end{multline}
```

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• Next, try:

\begin{multline}
382x^{13}+32x^{12}+x^{11}+x^{10}+x^9+x^8+x^7+321x^6\\
+x^5+19x^4+x^3+38x^2+x+1
\end{multline}

• Your output should look like:

$$382x^{13} + 32x^{12} + x^{11} + x^{10} + x^9 + x^8 + x^7 + 321x^6 + x^5 + 19x^4 + x^3 + 38x^2 + x + 1$$
(4)

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• Next, try:

```
\begin{multline}
382x^{13}+32x^{12}+x^{11}+x^{10}+x^9+x^8+x^7+321x^6\\
+x^5+19x^4+x^3+38x^2+x+1
\end{multline}
```

• Your output should look like:

$$382x^{13} + 32x^{12} + x^{11} + x^{10} + x^9 + x^8 + x^7 + 321x^6 + x^5 + 19x^4 + x^3 + 38x^2 + x + 1$$
 (4)

• Try this again using the commands \begin{equation}, \begin{split}, etc.