

Math 301 – Homework x solutions

Name

August 17, 1984

Problem x.y.z. Modify x.y.z to be the exercise number you are working on. Delete this text and write the exercise statement here. The text here is inside an “exercises environment.”

Solution. Delete this and write your solution here. □

Problem w.x.y. Write the next question here. It’s useful to have the question statement here when you’re studying later.

Proof. This is a proof for you to write. □

A few commands and conventions

Here are some useful commands for writing math in L^AT_EX. This is how you can use math mode within a sentence, which is sometimes called in-line mode: $A \subseteq \mathbb{R}^n$. We can also make math appear centered and on its own line. This is often called a *displayed* equation:

$$\sup S = \infty \text{ and } \inf S = -2.$$

Remember, when writing math, punctuation matters. Even displayed equations should have a period if they end a sentence. For example, we have

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

Notice that you need a blank space in between lines of code to start a new paragraph.

Here is how to write limits in in-line mode: $\lim_{x \rightarrow x_0} f(x) = L$. The output looks slightly different in displayed mode.

$$\lim_{x \rightarrow x_0} f(x) = L.$$

Either way, it looks funny if you forget the backslash before the `lim` command. Do you agree? This is a limit with a missing backslash: $lim_{x \rightarrow x_0} f(x) = L$.

Align environment

For equations that span several lines, we use the align environment. The `&` symbol tells where to anchor each line of the equation. The double backslash makes a new line.

Proof. We claim that $\lim_{n \rightarrow \infty} a_n = 7/3$. Let $\epsilon > 0$ and let $N = \frac{1}{3} \left(\frac{106}{3\epsilon} - 7 \right)$. Observe that if $n > N$,

$$\begin{aligned} |a_n - 7/3| &= \left| \frac{7n - 19}{3n + 7} - \frac{7}{3} \right| \\ &= \left| \frac{3(7n - 19) - 7(3n + 7)}{3(3n + 7)} \right| \\ &= \frac{106}{3(3n + 7)} \\ &< \frac{106}{3(3N + 7)} \\ &= \epsilon. \end{aligned}$$

□

Notice above that we used `\left` and `\right` before the parentheses and absolute value bars to make them scale to the right size that would fit around the taller fractions.

0.1 Equation labels

For equations that you'd like to label and refer back to, there are a couple of options. The first is the `equation` environment, along with the `label` and `ref` commands:

$$|\sin x| \leq 1 \tag{1}$$

The displayed expression (1) gets labeled with a numbered value, so that you can refer back to in the main body discussion. You can do this with the `align` environment as well. Notice that leaving out the asterisk introduces number labels to each line:

$$\begin{aligned} |a + b|^2 &= (a + b)^2 && (2) \\ &= a^2 + 2ab + b^2 \\ &= |a|^2 + 2ab + |b|^2 \\ &\leq |a|^2 + 2|a||b| + |b|^2 && (3) \\ &= (|a| + |b|)^2. \end{aligned}$$

This way, you can again reference expressions (3) and (2) and not worry about keeping track of the numbers. You can also reference sections and subsections, like Subsection 0.1.

Problem w.x.y. You can start a new page with the `\newpage` command.