# Working with Math environments in texor

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**Abstract** This is a small sample article to demonstrate usage of the texor package to convert math environments.

## 1 Introduction

Math typesetting has always been a highlight of LaTeX, making it a de facto choice among academics and researchers globally. However, in the move to humble web interfaces, math has been traditionally hard to describe. There have been advances in JavaScript libraries to better typeset and present math in web pages but not all LaTeX commands/math functions are available.

### MathJax

The **texor** package uses Mathjax version 3 to enhance the visual look of the math content in HTML.

The core goal of the MathJax project is the development of its state-of-the-art, open source, JavaScript platform for display of mathematics. The key advantages are (Mathjax authors , 2021):

- High-quality display of mathematics notation in all browsers.
- No special browser setup required.
- Support for LaTeX, MathML, and other equation markup directly in the HTML source.
- Support for accessibility, copy and paste, and other rich functionality.
- Interoperability with other applications and math-aware search.

As **texor** calls **rmarkdown** to render the R Markdown file into HTML, the `rjtools::rjournal_web_article` template uses MathJax as the math engine by default. We also specify the Mathjax version in the metadata of the generated Rmarkdown file.

## 2 Inline math

One can define inline math in LaTeX using commands `\(..\)` or `$..$`.

| Command | Math |
|---|---|
| `\(\mu = (0,0,0)^\top \)` | $\mu = (0,0,0)^\top$ |
| `$\mu = (0,0,0)^\top $` | $\mu = (0,0,0)^\top$ |

**Table 1:** Inline math syntax and its output side by side.

## 3 Display math

Display math refers to equations typeset on separate lines rather than in line with the text. Almost all LaTeX equations can be rendered by MathJax.

```
\begin{align}
f(x) = \frac{1}{\sigma\sqrt{2\pi}}
  \exp\left( -\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^{\!2}\,\right)
  \label{eq:1}
\end{align}
```

The code above will render as Equation 1.

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left( -\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^{2} \right) \tag{1}$$

## 4  Equation numbering

In LaTeX your equations get numbered automatically unless you are using \[..\] environment or \nonumber to suppress numbering. Equation numbering works a bit differently in **bookdown** (the base of the R Journal web article format) where it is mandatory to have a (\#eq:xx) which is described in more detail in Yihui (2023).

The **texor** package relieves authors from manually adding (\#eq:xx) to equations in R Markdown by using a pandoc Lua filter to convert existing \label{..} in the equations to (\#eq:xx) during conversion. Equation 2 shows such a use case of an equation being numbered by its label in R Markdown as well as LaTeX.

$$S_{T,s}(z_t) = X^\top K_{b,t}^* X(Z - z_t)^s, \tag{2}$$

Equation labels must start with the prefix eq: in bookdown. All labels in bookdown must only contain alphanumeric characters, :, -, and/or / as suggested in (Yihui , 2023). To accomadate this, the **texor** package has a lua filter implementation to correct and modify equation labels and references to the bookdown accepted format.

**LaTeX source code**

```
\begin{equation}\label{binomial pdf}
  f\left(k\right) = \binom{n}{k} p^k\left(1-p\right)^{n-k}

\end{equation}
The reference to above equation \eqref{binomial pdf}
```

**Generated R markdown using texor**

```
$$\label{binomial pdf}
  f\left(k\right) = \binom{n}{k} p^k\left(1-p\right)^{n-k}    (\#eq:binomial-pdf)$$

The reference to above equation \@ref(eq:binomial-pdf)
```

**Rendering of the above example**

$$f(k) = \binom{n}{k} p^k (1-p)^{n-k} \tag{3}$$

The reference to above equation (3)

## 5  Custom math commands

The existence of user-defined LaTeX commands intended for the Math environments will work as long as they do not contain non-math LaTeX commands or commands from other CTAN math packages.

**Renders correctly in HTML**

```
\newcommand{\ABS}[1]{|#1|}
```

$$|\sigma^2| = \pm 1$$

**Does not render correctly in HTML**

```
\newcommand{\rotatethis}[1]{\rotatebox[origin=c]{90}{$#1$}}
```

$$\rotatethis{b} = \pm 1$$

## 6 Unsupported LaTeX commands

Altough MathJax does a good job of supporting most LaTeX math functions, some functions do not currently work. Common examples are `\bm` and `\boldmath`, for which `\mathbf` can be used instead.

## 7 Summary

In summary the **texor** package, with the help of pandoc and MathJax supports:

- Common math environments.
- Equation numbering.

## Bibliography

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