

1 Long Equations

Here is a long equation without line number.

$$\begin{aligned} \int_G \Theta(f_{\underline{\varepsilon}}(t)) d\mu(t) &= - \int_G f_{\underline{\varepsilon}}^4(t) d\mu(t) \\ &+ (b^2 + 2a^2) \int_G f_{\underline{\varepsilon}}^2(t) d\mu(t) + 2ab^2 \int_G f_{\underline{\varepsilon}}(t) d\mu(t) + a^2b^2 - a^4. \end{aligned}$$

Here is the same long equation with a single equation number. The "notag" is used to suppress numbering the first line.

$$\begin{aligned} \int_G \Theta(f_{\underline{\varepsilon}}(t)) d\mu(t) &= - \int_G f_{\underline{\varepsilon}}^4(t) d\mu(t) \\ &+ (b^2 + 2a^2) \int_G f_{\underline{\varepsilon}}^2(t) d\mu(t) + 2ab^2 \int_G f_{\underline{\varepsilon}}(t) d\mu(t) + a^2b^2 - a^4. \quad (1) \end{aligned}$$

Here is the same long equation with a single equation number, but centered. Here the combination of "equation" and "split" environments is used. We prefer this version for numbered long equations.

$$\begin{aligned} \int_G \Theta(f_{\underline{\varepsilon}}(t)) d\mu(t) &= - \int_G f_{\underline{\varepsilon}}^4(t) d\mu(t) \\ &+ (b^2 + 2a^2) \int_G f_{\underline{\varepsilon}}^2(t) d\mu(t) + 2ab^2 \int_G f_{\underline{\varepsilon}}(t) d\mu(t) + a^2b^2 - a^4. \quad (2) \end{aligned}$$

2 Multiline Equations

EXAMPLE 1.

Here is a string of equations typeset with gather.

$$\begin{aligned} a_n &= \frac{1}{2\pi} \int_{-\pi}^{\pi} f(x)e^{-inx} dx = \frac{1}{2\pi} \int_{-\pi}^{\pi} f_0(x)e^{-inx} dx \\ &= \lim_{n \rightarrow \infty} \frac{1}{2\pi} \int_{-\pi}^{\pi} f_{\delta_n}(x)e^{-inx} dx = \lim_{n \rightarrow \infty} \frac{1}{2\pi} \int_{-\infty}^{\infty} g_{\delta_n}(t) \left(\int_{-\pi}^{\pi} \frac{e^{-inx}}{|x-t|^{1-\alpha}} dx \right) dt \\ &= \frac{1}{2\pi} \int_{-\pi}^{\pi} U_{\alpha}^{\mu}(x)e^{-inx} dx. \end{aligned}$$

Here is the same set of equations typeset with align.

$$\begin{aligned} a_n &= \frac{1}{2\pi} \int_{-\pi}^{\pi} f(x)e^{-inx} dx = \frac{1}{2\pi} \int_{-\pi}^{\pi} f_0(x)e^{-inx} dx \\ &= \lim_{n \rightarrow \infty} \frac{1}{2\pi} \int_{-\pi}^{\pi} f_{\delta_n}(x)e^{-inx} dx = \lim_{n \rightarrow \infty} \frac{1}{2\pi} \int_{-\infty}^{\infty} g_{\delta_n}(t) \left(\int_{-\pi}^{\pi} \frac{e^{-inx}}{|x-t|^{1-\alpha}} dx \right) dt \\ &= \frac{1}{2\pi} \int_{-\pi}^{\pi} U_{\alpha}^{\mu}(x)e^{-inx} dx. \end{aligned}$$

Each of these two versions has advantages over the other. The first looks better on the page while the second highlights the fact that a formula for a_n is underway.

The second formulation introduces an "overfill" on the second line, however, so must be altered to fit on the page properly. Here is a reformulation.

$$\begin{aligned}
a_n &= \frac{1}{2\pi} \int_{-\pi}^{\pi} f(x)e^{-inx} dx = \frac{1}{2\pi} \int_{-\pi}^{\pi} f_0(x)e^{-inx} dx \\
&= \lim_{n \rightarrow \infty} \frac{1}{2\pi} \int_{-\pi}^{\pi} f_{\delta_n}(x)e^{-inx} dx \\
&= \lim_{n \rightarrow \infty} \frac{1}{2\pi} \int_{-\infty}^{\infty} g_{\delta_n}(t) \left(\int_{-\pi}^{\pi} \frac{e^{-inx}}{|x-t|^{1-\alpha}} dx \right) dt \\
&= \frac{1}{2\pi} \int_{-\pi}^{\pi} U_{\alpha}^{\mu}(x)e^{-inx} dx.
\end{aligned}$$

We prefer this third version.

EXAMPLE 2.

Here is a common alignment first without line number, then with.

$$\begin{aligned}
P(G_N) &\leq \sum_{\frac{\mu}{2} < j \leq \mu} P \left(\|B'_j\|_T > \frac{q_j N}{4 T} \right) \\
&\leq \sum_{\frac{\mu}{2} < j \leq \mu} \frac{4T}{N q_j} C'_T q_j (\log p_{j+1})^{3/2} \\
&\leq \frac{4T}{N} C'_T \mu (\log p_{\mu+1})^{3/2} \\
&\leq \frac{4TC'_T}{N} \mu \exp \left(\frac{3(\mu+1)l}{\gamma} \right),
\end{aligned}$$

$$\begin{aligned}
P(G_N) &\leq \sum_{\frac{\mu}{2} < j \leq \mu} P \left(\|B'_j\|_T > \frac{q_j N}{4 T} \right) \\
&\leq \sum_{\frac{\mu}{2} < j \leq \mu} \frac{4T}{N q_j} C'_T q_j (\log p_{j+1})^{3/2} \\
&\leq \frac{4T}{N} C'_T \mu (\log p_{\mu+1})^{3/2} \\
&\leq \frac{4TC'_T}{N} \mu \exp \left(\frac{3(\mu+1)l}{\gamma} \right),
\end{aligned} \tag{3}$$

Here is one more example of a numbered multiline equation.

$$\begin{aligned}
P_k(s) &= \frac{1}{h_k} + \frac{e^{-s}}{h_k - 1} + \cdots + \frac{e^{-(h_k-1)s}}{1} - \frac{e^{-(h_k+1)s}}{1} - \cdots - \frac{e^{-2h_k s}}{h_k} \\
&= \sum_{j=0}^{h_k-1} \frac{e^{-js}}{h_k - j} - \sum_{j=0}^{h_k-1} \frac{e^{-(2h_k-j)s}}{h_k - j} \\
&= \sum_{n=1}^{h_k} \frac{e^{-(h_k-n)s} - e^{-(h_k+n)s}}{n}.
\end{aligned} \tag{4}$$