1 Long Equations

Here is a long equation without line number.

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

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

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

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.

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

2 Multiline Equations

EXAMPLE 1.

Here is a string of equations typeset with gather.

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

Here is the same set of equations typeset with align.

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

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.

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

We prefer this third version.

Example 2.

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

$$\begin{aligned}
P(G_N) &\le \sum_{\frac{\mu}{2}<j\le\mu} P\left(\|B_j'\|_T > \frac{q_j}{4}\frac{N}{T}\right) \\
&\le \sum_{\frac{\mu}{2}<j\le\mu} \frac{4T}{Nq_j}C_T' q_j\left(\log p_{j+1}\right)^{3/2} \\
&\le \frac{4T}{N}C_T'\mu\left(\log p_{\mu+1}\right)^{3/2} \\
&\le \frac{4TC_T'}{N}\mu\exp\left(\frac{3(\mu+1)l}{\gamma}\right),
\end{aligned}$$

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

Here is one more example of a numbered multiline equation.

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