NOTE: The syntax follows that of Sakurai's textbook "Modern Quantum Mechanics." Namely, $|j_1, j_2, j, m\rangle$.

We can simply inline the output by tacking \$'s onto it: $\left|\frac{1}{2}, \frac{1}{2}, 0, 0\right\rangle = -\sqrt{\frac{1}{2}} \left|\frac{1}{2}, \frac{1}{2}, \frac{-1}{2}, \frac{1}{2}\right\rangle + \sqrt{\frac{1}{2}} \left|\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{-1}{2}\right\rangle$.

We can insert the result into math mode by tacking \$\$'s onto it:

$$\left|\frac{1}{2}, \frac{1}{2}, 0, 0\right\rangle = -\sqrt{\frac{1}{2}} \left|\frac{1}{2}, \frac{1}{2}, \frac{-1}{2}, \frac{1}{2}\right\rangle + \sqrt{\frac{1}{2}} \left|\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{-1}{2}\right\rangle$$

We can enter a full-fledged math mode with alignment by adding two backslashes at the end of the lines, and aligning at the equal sign by tacking an ampersand onto it:

$$\begin{aligned}
\left|\frac{1}{2}, \frac{1}{2}, 0, 0\right\rangle &= -\sqrt{\frac{1}{2}} \left|\frac{1}{2}, \frac{1}{2}, \frac{-1}{2}, \frac{1}{2}\right\rangle + \sqrt{\frac{1}{2}} \left|\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{-1}{2}\right\rangle \\
\left|\frac{1}{2}, \frac{1}{2}, 1, 1\right\rangle &= \left|\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}\right\rangle \\
\left|\frac{1}{2}, \frac{1}{2}, 1, 0\right\rangle &= \sqrt{\frac{1}{2}} \left|\frac{1}{2}, \frac{1}{2}, \frac{-1}{2}, \frac{1}{2}\right\rangle + \sqrt{\frac{1}{2}} \left|\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{-1}{2}\right\rangle \\
\left|3, \frac{3}{2}, \frac{3}{2}, \frac{-1}{2}\right\rangle &= -\sqrt{\frac{2}{7}} \left|3, \frac{3}{2}, -2, \frac{3}{2}\right\rangle + \sqrt{\frac{12}{35}} \left|3, \frac{3}{2}, -1, \frac{1}{2}\right\rangle - \sqrt{\frac{9}{35}} \left|3, \frac{3}{2}, 0, \frac{-1}{2}\right\rangle + \sqrt{\frac{4}{35}} \left|3, \frac{3}{2}, 1, \frac{-3}{2}\right\rangle \\
\left|3, \frac{3}{2}, \frac{3}{2}, \frac{3}{2}\right\rangle &= -\sqrt{\frac{1}{35}} \left|3, \frac{3}{2}, 0, \frac{3}{2}\right\rangle + \sqrt{\frac{4}{35}} \left|3, \frac{3}{2}, 1, \frac{1}{2}\right\rangle - \sqrt{\frac{2}{7}} \left|3, \frac{3}{2}, 2, \frac{-1}{2}\right\rangle + \sqrt{\frac{4}{7}} \left|3, \frac{3}{2}, 3, \frac{-3}{2}\right\rangle \\
\left|3, \frac{3}{2}, \frac{9}{2}, \frac{5}{2}\right\rangle &= \sqrt{\frac{5}{12}} \left|3, \frac{3}{2}, 1, \frac{3}{2}\right\rangle + \sqrt{\frac{1}{2}} \left|3, \frac{3}{2}, 2, \frac{1}{2}\right\rangle + \sqrt{\frac{1}{12}} \left|3, \frac{3}{2}, 3, \frac{-1}{2}\right\rangle \\
\left|3, \frac{3}{2}, \frac{9}{2}, \frac{9}{2}\right\rangle &= \left|3, \frac{3}{2}, 3, \frac{3}{2}\right\rangle
\end{aligned}$$

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