1. All is fine before a standard LaTeX display:

$$x \neq y$$

2. and as of 2022 also before amsmath displays:

$$x \neq y \tag{1}$$

However, we do not get line numbers in front of displays from other packages, for example, those from the breqn package:

$$\begin{aligned}
0 &< x \\
&= x_0 + x_1 + x_2 + \cdots + x_{n-1} + x_n
\end{aligned} \tag{2}$$

3. They only show up again after the display.