Types of Limits

| Function | $f(a) = b$ | There's a solid dot at $(a,b)$.
|----------|-----------|------------------|
| Finite Limits | \[
\lim_{{x \to a}} f(x) = b
\]
| | \[
\lim_{{x \to a^-}} f(x) = b
\]
| | \[
\lim_{{x \to a^+}} f(x) = b
\]
| | \[
\begin{align*}
\text{f approaches the point } (a,b) & \text{ from both sides} \\
\text{f approaches the point } (a,b) & \text{ from the left side} \\
\text{f approaches the point } (a,b) & \text{ from the right side}
\end{align*}
\]
| | There is an open dot or a solid dot at $(a,b)$
| Infinite Limits | \[
\lim_{{x \to a}} f(x) = \infty
\]
| | \[
\lim_{{x \to a^-}} f(x) = -\infty
\]
| | \[
\begin{align*}
\text{f approaches vertical asymptote } x = a & \text{ and goes up} \\
\text{f approaches vertical asymptote } x = a & \text{ and goes down}
\end{align*}
\]
| Limits at Infinity | \[
\lim_{{x \to \infty}} f(x) = L
\]
| | \[
\lim_{{x \to -\infty}} f(x) = L
\]
| | \[
\begin{align*}
\text{f approaches horizontal asymptote } y = L & \text{ off to the right} \\
\text{f approaches horizontal asymptote } y = L & \text{ off to the left}
\end{align*}
\]