Practice with limits!

If you want to say that a sequence $(a_i)_{i\in\mathbb{N}}$ converges to the limit L, you write that

$$(\forall \varepsilon > 0)\ (\exists N)\ (\forall i)\ ((i > N) \to (|a_i - L| < \varepsilon))\,.$$

In the case $L = 5$, this reads

$$(\forall \varepsilon > 0)\ (\exists N)\ (\forall i)\ ((i > N) \to (|a_i - 5| < \varepsilon))\,.$$

Now, if you want to say that the sequence $(a_i)_{i\in\mathbb{N}}$ converges to *some* limit, without specifying what the limit is, you write

$$(\exists L)\ (\forall \varepsilon > 0)\ (\exists N)\ (\forall i)\ ((i > N) \to (|a_i - L| < \varepsilon))\,.$$

Finally, if you want to say that the sequence $(a_i)_{i\in\mathbb{N}}$ does not converge, then you want to negate the previous displayed line. You get

$$(\forall L)\ (\exists \varepsilon > 0)\ (\forall N)\ (\exists i)\ ((i > N) \wedge (|a_i - L| \not< \varepsilon))\,.$$

Practice!

(1) Show that the sequence $\left(\frac{1}{i}\right)_{i\in\mathbb{N}^*} = \left(1, \frac{1}{2}, \frac{1}{3}, \ldots\right)$ converges.

(2) Show that the sequence $(i)_{i\in\mathbb{N}^*} = (1, 2, 3, \ldots)$ does not converge.