1. Find

\[
\lim_{x \to 2} \frac{\frac{1}{x} - \frac{1}{2}}{x - 2}
\]

\[
\lim_{x \to 2} \frac{1}{x} - \frac{1}{2} = \lim_{x \to 2} \frac{2-x}{2x} = \lim_{x \to 2} \frac{2-x}{2x(x-2)} = -\lim_{x \to 2} \frac{1}{2} = -\frac{1}{4}
\]

2. If

\[
f(x) = \begin{cases} |x| & \text{if } x \text{ is rational} \\ 0 & \text{if } x \text{ is irrational} \end{cases}
\]

show that

\[
\lim_{x \to 0} f(x) = 0
\]

Using the squeeze theorem note that \( f(x) \) is between the functions \( y = 0 \) and \( y = |x| \).

So

\[
0 \leq f(x) \leq |x|
\]

\[
0 = \lim_{x \to 0} 0 \leq \lim_{x \to 0} f(x) \leq \lim_{x \to 0} |x| = 0
\]

which shows that

\[
\lim_{x \to 0} f(x) = 0
\]