(15) Given $\varepsilon > 0$.

$$|f(x)g(x) - AB| = |f(x)g(x) - Ag(x) + Ag(x) - AB| \le |g(x)||f(x) - A| + |A|\,|g(x) - B|$$

When I choose δ I will insist that

$0 < |x - p| < \delta \Rightarrow |g(x) - B| < 1$

Then $\quad |g(x)| - |B| < |g(x) - B| < 1$

so $|g(x)| < |B| + 1$

With this in mind

$$|f(x)g(x) - AB| \le (|B| + 1)|f(x) - A| + (|A| + 1)|g(x) - B|$$

Take δ_1 so that $\quad 0 < |x - p| < \delta_1 \Rightarrow |f(x) - A| < \dfrac{\varepsilon}{2(|B| + 1)}$

Take δ_2 so that $\quad 0 < |x - p| < \delta_2 \Rightarrow |g(x) - B| < \dfrac{\varepsilon}{2(|A| + 1)}$

I assume that $\dfrac{\varepsilon}{2(|A| + 1)} < 1$.

Let $\delta = \min\{\delta_1, \delta_2\}$. Then

$$0 < |x - p| < \delta \Rightarrow |f(x)g(x) - AB| \le (|B| + 1)\frac{\varepsilon}{2(|B| + 1)} + (|A| + 1)\frac{\varepsilon}{2(|A| + 1)}$$

$$= \frac{\varepsilon}{2} + \frac{\varepsilon}{2} < \varepsilon$$

$$\therefore \lim_{x \to p} f(x)g(x) = AB$$