Question 1. *If K is a constant, show that $K(x-a) = o(x-a)$ if and only if $K = 0$.*

Solution. The sufficiency is obvious, so prove the necessity. Recall that $f(x) = o(g(x))$ as $x \to a$ iff for any $\varepsilon > 0$ there is $\delta > 0$, such that $|f(x)| \leq \varepsilon |g(x)|$ for all x with $0 < |x-a| < \delta$. Use this definition in the case when $f(x) = K(x-a)$ and $g(x) = x-a$: for any $\varepsilon > 0$ there is $\delta > 0$ such that $|K(x-a)| \leq \varepsilon |x-a|$ for all x, such that $0 < |x-a| < \delta$. Since $|x-a| > 0$, we can divide both sides of the above inequality by $|x-a|$ and obtain $|K| < \varepsilon$. But this is true for any $\varepsilon > 0$. Therefore, $|K| = 0$, i. e. $K = 0$. □