17.9 (d) $g(x)=x^3$ is continuous at x_0.

Consider $\delta_1=1$. $|x-x_0|<\delta_1=1 \Rightarrow |x|<|x_0|+1$

$$\Rightarrow |x^2+x_0x+x_0^2| \le |x|^2+|x_0||x|+x_0^2 < (|x_0|+1)^2+|x_0|(|x_0|+1)+x_0^2$$

Then $\forall \epsilon>0$, consider $\delta_2=\dfrac{\epsilon}{(|x_0|+1)^2+|x_0|(|x_0|+1)+x_0^2}>0$ and $\delta=\min\{\delta_1,\delta_2\}>0$.

$\forall x\in\mathbb{R}$ and $|x-x_0|<\delta$, we have

$$|g(x)-g(x_0)| = |x^3-x_0^3| = |x-x_0|\cdot|x^2+x_0x+x_0^2| < |x-x_0|\cdot((|x_0|+1)^2+|x_0|\cdot(|x_0|+1)+x_0^2)$$

$$< \delta_2\cdot((|x_0|+1)^2+|x_0|\cdot(|x_0|+1)+x_0^2) = \epsilon$$

17.12 (a) Consider any $x_0\in(a,b)$. $f(x)$ is continuous at x_0

$\Rightarrow \forall\epsilon>0,\ \exists\delta>0,\ \forall x\in(a,b)$ and $|x-x_0|<\delta$, we have $|f(x)-f(x_0)|<\epsilon$.

$x_0\in(a,b) \Rightarrow (a,b)\cap\{x: |x-x_0|<\delta\}\neq\phi$. By the denseness of rational numbers,

$\exists r\in\mathbb{Q}$ and $r\in(a,b)\cap\{x:|x-x_0|<\delta\} \Rightarrow |f(r)-f(x_0)|<\epsilon \Rightarrow |f(x_0)|<\epsilon$.

$|f(x_0)|<\epsilon,\ \forall\epsilon>0 \Rightarrow f(x_0)=0$. So $f(x)\equiv 0,\ \forall x\in(a,b)$

18.2 In the proof of Theorem 18.1, we apply the Bolzano-Weierstrass theorem. For $\{x_n\}_{n\in\mathbb{N}}\subseteq[a,b]$, $\exists\{x_{n_k}\}_{k\in\mathbb{N}}\subseteq\{x_n\}_{n\in\mathbb{N}}$, s.t.

$\lim\limits_{k\to\infty} x_{n_k} = x_0\in[a,b]$, because $x_{n_k}\in[a,b],\ \forall k$.

If $[a,b]$ is replaced by (a,b), we still get $\lim\limits_{k\to\infty}x_{n_k}=x_0\in[a,b]$ from $a<x_{n_k}<b$.

So the point x_0 can go outside the domain (a,b)