2.4.3 a) F polyn. $\Rightarrow$ F cont. $\Rightarrow$ $A = F^{-1}([0,\infty))$ closed, $C = F^{-1}((0,\infty))$ open. $\Rightarrow \bar{A} = A$, $C \subset \mathring{A}$.
$\Rightarrow \partial A = \bar{A} \setminus \mathring{A} \subset A \setminus C = F^{-1}(0) = B$.

b) Let $F(x,y) = x^2 y$, then $p = (0,1) \in B \setminus \partial A$. Proof: Let $q = (a,b) \in B(p,1)$. $\Rightarrow a^2 + (b-1)^2 < 1 \Leftrightarrow a^2 + b^2 = 2b$
$\Rightarrow b > 0 \Rightarrow F(q) \geq 0$. Thus, $B(p,1) \subset A \Rightarrow p \in \mathring{A} \Rightarrow p \notin \partial A$

2.4.5 Let $x \in [0,1]$. Since $\bar{\mathbb{Q}} = \mathbb{R}$, $\exists \{x_n\} \subset [0,1] \cap \mathbb{Q}$: $x_n \to x$. By continuity, $f(x) = \lim_{n\to\infty} f(x_n) = \lim_{n\to\infty} g(x_n) = g(x)$

2.4.8 Let S be connected, $f : S \to \mathbb{R}$ locally const, i.e. $\forall a \in \mathbb{R}$: $f^{-1}(a) \subset S$ open. For $p \in S$ set $U = f^{-1}(f(p)) \neq 0$, $V = f^{-1}(\mathbb{R} \setminus \{f(p)\})$. Then $U, V \subset S$ open, $U \neq \emptyset$, and $S = U \dot\cup V$.
By connectedness of S, $V = \emptyset$ and $f = f(p)$.

2.4.9 If $S = U \dot\cup V$ is disconn., $f : S \to \mathbb{R}$ def. by $f(p) = \begin{cases} 2, & p \in U \\ 3, & p \in V \end{cases}$ is cont. Conversely, if such an f exists, setting $U = f^{-1}(2)$, $V = f^{-1}(3)$, yields disconn. of S.
