CHAPTER 1: Introduction to the Topology of Euclidean Space $\mathbb{R}^n$.

2-1. Sketch the following subsets of $\mathbb{R}^2$. Sketch their boundary and the interior. Study whether the following are closed, open, bounded and/or convex.

(a) $A = \{(x, y) \in \mathbb{R}^2 : 0 < \|(x, y) - (1, 3)\| < 2\}$.
(b) $B = \{(x, y) \in \mathbb{R}^2 : y \leq x^3\}$.
(c) $C = \{(x, y) \in \mathbb{R}^2 : |x| < 1, |y| \leq 2\}$.
(d) $D = \{(x, y) \in \mathbb{R}^2 : |x| + |y| < 1\}$.
(e) $E = \{(x, y) \in \mathbb{R}^2 : y < x^2, y < 1/x, x > 0\}$.
(f) $F = \{(x, y) \in \mathbb{R}^2 : xy \leq y + 1\}$.
(g) $G = \{(x, y) \in \mathbb{R}^2 : (x - 1)^2 + y^2 \leq 1, x \leq 1\}$.

2-2. Let A be a subset of $\mathbb{R}^2$. Discuss which of the following assertions are true.

(a) $\text{Int}(A) = A - \partial(A)$.
(b) $\partial(A) = \partial(\mathbb{R}^2 - A) = \partial(A^C)$.
(c) $\partial(A)$ is bounded.
(d) A is closed if and only if A^C is open.
(e) A is bounded if and only if A^C is not bounded.
(f) A is closed if and only if $\partial(A) \subset A$.
(g) A is open if and only if $(\partial A) \cap A = \emptyset$.