Question 1: (Section 6.4, #2)

- $g \circ h = g(h(x)) = g(3x + 2) = (3x + 2)^2$.
- $h \circ g = h(g(x)) = h(x^3) = 3x^3 + 2$.
- $g \circ h \neq h \circ g$, thus composition is not ....

Question 2:

(a) The image of f is all the odd integers. The image of $f(X)$ where $X = \{ x \in \mathbb{Z} \mid x \text{ is even} \}$ is every other odd integer.

(b) The image of f is every positive real number. The image of $f(X)$ where $X = (0, 1]$ is $(\infty, 1]$.

(c) The image of f is $[-1, 1]$. The image of $f(X)$ where $X = [0, \pi)$ is also $[-1, 1]$.

Question 3:

(a) *Proof.* Suppose A and B are sets with subsets $U, V \subseteq A$, and $f : A \to B$ is a function. Let b be an aribtrary element of $f(U \cap V)$. This means that there exists an $x \in U \cap V$ such that $f(x) = b$. Therefore, $\exists x \in U$ such that $f(x) = b$, and $\exists x \in V$ such that $f(x) = b$. Therefore, $b \in f(U) \land b \in f(V) \to b \in f(U) \cap f(V)$. So, $f(U \cap V) \subseteq f(U) \cap f(V)$. $\square$

Question 4:

(a) $f^{-1}(Y) = [0, \infty)$.

(b) I think this is like all $[n\pi, (n + 1)\pi]$ only for even n.

(c) I think this is $\{ 1, 2, 10, 12, 14, 16, 18 \}$.