Q4)

a) $\forall a \in S, \forall b \in S, P(a, b)$ where $S = \mathbb{Q}$

$P(a, b) = \frac{a}{b^2+1} \in S$

b) $\forall a \in S, \exists b \in S, P(a, b)$ where $S = \mathbb{R}$

$P(a, b) = a = 7b^3 + 10$

c) $\exists a \in S, \forall b \in S, P(a, b)$ where $S = \mathbb{N}$

$P(a, b) = a \le b$

d) $\exists a \in S, \exists b \in S, P(a, b)$ where $S = \{-\frac{1}{3}, -\frac{1}{2}, \frac{1}{2}, \frac{1}{2}\}$

$P(a, b) = \sin\left(\frac{\pi a}{2}\right) + \cos\left(\frac{\pi b}{2}\right)$