Which of the following formalizes the definition of the predicate Pr(x) over the set of integers, and evaluates to T exactly when x is prime. (Select all and only correct options.)

1.
$$\forall a \in \mathbb{Z}^{\neq 0} ((x > 1 \land a > 0) \rightarrow F((a, x)))$$

2.
$$\neg \exists a \in \mathbb{Z}^{\neq 0} (x > 1 \land (a = 1 \lor a = x) \land F((a, x)))$$

3.
$$(x > 1) \land \forall a \in \mathbb{Z}^{\neq 0} ((a > 0 \land F((a, x))) \rightarrow (a = 1 \lor a = x))$$

4.
$$(x > 1) \land \forall a \in \mathbb{Z}^{\neq 0} ((a > 1 \land \neg (a = x)) \rightarrow \neg F((a, x)))$$