Friday
Prove the following statement form is a tautology using a truth table.

\[ ((P \Rightarrow Q) \land (R \Rightarrow S) \land (P \lor R)) \Rightarrow (Q \lor S) \]

Saturday
Prove the following statement

\[ \forall x \in \mathbb{R} \exists y \in \mathbb{R} \, (xy + y = 7) \]

Sunday
Prove that \( \sqrt{17} \) is irrational.

Monday
Prove that \( (A \times B) \cap (B \times A) \subseteq (A \cap B) \times (A \cap B) \)

Tuesday
Let \( I \) be an arbitrary index set and \( A_i \) sets indexed by \( I \). Prove or disprove:

\[ \left( \bigcup_{i \in I} A_i \right) - B = \bigcup_{i \in I} (A_i - B) \]

Wednesday
Use induction to prove that:

\[ \sum_{m=1}^{n} \frac{1}{(2m-1)(2m+1)} = \frac{n}{2n+1} \]

Thursday
Define a relation \( R \) on \( \mathbb{Z}^2 \) via \((a, b)R(x, y)\) if and only if \( a \equiv_4 x \) and \( b \equiv_5 y \). Prove or disprove that \( R \) is an equivalence relation.

Friday
Solve \( 17x^2 + 4 \equiv 32 \mod 50 \)

Saturday
Show that the function \( f \), below, is one-to-one.

\[ f: \mathbb{R} \to \mathbb{R}^2 \]
\[ x \to (x^2, x^3) \]

Sunday
The function \( f \), below, is not invertible. Define the largest possible restriction, \( g := f \mid_S \) such that \( g \) is invertible. Then find the rule that defines \( g \).