Polynomial time on a TM

= polynomial time on any digital computer
$S: \{(s, b), (b, t)\}$  Yes

$S: \{(s, a), (a, t)\}$  No

$S: \{(s, a)\}$  No

$S: \{s)\}$  No
You can verify LongestPath in polynomial time.

\[
\text{SAT} \quad \begin{array}{c}
\text{CNF (and of)} \\
0, 1, 5
\end{array}
\]

\[
\phi \equiv (x_1 \lor x_2) \land (\bar{x}_1 \lor x_3 \lor \bar{x}_4) \land (\bar{x}_2 \lor \bar{x}_4)
\]

Is there a setting of the variables that makes \( \phi \) true?

\[
\begin{array}{cccc}
T & T & T & T \\
F & F & F & F
\end{array}
\]

\[
\phi \equiv (x_1 \lor x_2) \land (\bar{x}_1 \lor x_3) \land (x_1 \lor \bar{x}_2) \land (\bar{x}_1 \lor \bar{x}_2)
\]

SAT is verifiable in poly-time. \( \therefore \text{SAT} \in \text{NP} \)
Are there problems that can be verified in poly time, but cannot be solved in poly time?

unanswered
Y  subtraction of 2 ints
X  addition of 2 ints

Input y to Y  (6, 4)

f(y) = (6, -4)

f(y) input to addition \( \Rightarrow \) 6 + (-4) = 2
If $y \leq x$ then $x \in P \Rightarrow y \in P$

$\text{Pf}$

$y \in P \Rightarrow x \in P$

Diagram:

- $y$ -> $f(y)$ -> $x$ -> $X$
- $X$:
  - Yes
  - No
- $\text{poly time}$