

## Recursion Theorem

Let  $T$  be some Turing machine that computes some function  $t$ . Then there will always exist another Turing m/c  $R$  that does the same thing as  $t$  when  $t$  is applied to a description of itself.

## Reducibility (A technique of proving undecidability)

We reduce Hard problem to easier problem. The solution of easier problem then can be used to solve the harder problem.

Theorem:  $P$  is undecidable

Proof: 1) Assume  $P$  is decidable

- 2) Reduce  $\therefore$  acceptance problem for Turing machine, ATM (a HARD PROBLEM) into  $P$  (an EASY PROBLEM).
- 3) Use the solution of  $P$  to solve ATM.
  - Use decidability of  $P$  to decide ATM.
  - Build a TM to decide ATM using the TM to decide  $P$  as subroutine.

BUT WE KNOW THAT DECIDER FOR ATM CANNOT EXIST

Hence,  $P$  is Undecidable