499   The Substitution Law does not work for interactive variables.
(a)   Show an example of the failure of the law.
(b)   Develop a new Substitution Law for interactive variables.

After trying the question, scroll down to the solution.

(a)   Show an example of the failure of the law.
§   Let x be an interactive variable, and let t be time. Suppose an assignment takes time 1 .

$$x := 3. \ x'{=}x \wedge t'{=}t \ = \ x'{=}3 \wedge t'{=}t{+}1$$

whereas the Substitution Law would say $x'{=}3 \wedge t'{=}t$. The problem is that assignment to an interactive variable has to take time.

(b)   Develop a new Substitution Law for interactive variables.
§   Let a be the time for the assignment. Let y be any other interactive variable.

$$x := e. \ P$$
$$= \ x(t{+}a) = e \ \wedge \ (\forall t''{\cdot} \ t{\le}t''{\le}t{+}a \Rightarrow y''{=}y) \wedge \ (\text{substitute } t{+}a \text{ for } t \text{ in } P)$$