

We have defined substitution for our arithmetic language with **let** as follows:

$$\begin{aligned}
 z[v/x] &= z & (t_1 \odot t_2)[v/x] &= t_1[v/x] \odot t_2[v/x] \quad \odot \in \{+, \times, \div\} \\
 y[v/x] &= \begin{cases} v & \text{if } x = y \\ y & \text{otherwise} \end{cases} & (\text{let } y = t_1 \text{ in } t_2)[v/x] &= \begin{cases} \text{let } y = t_1[v/x] \text{ in } t_2 & \text{if } x = y \\ \text{let } y = t_1[v/x] \text{ in } t_2[v/x] & \text{otherwise} \end{cases}
 \end{aligned}$$

(y.t2) t1

1. What is the result of the following substitutions?

(a) `(let a = 5 in a + b)[4/b]` the answer is not 9! ! Do not evaluate the substitution
`let a = 5 in a + 4`

(b) `(let a = 5 in a + b)[4/a]` 5[4/a]
`let a = 5 in a + b`

2. Suppose we were to add a renaming feature to our language `rename x to y in t`, with the intuition that variable x inside t should be interpreted as variable y . Write the case of the substitution function to account for this feature (i.e., what is `(rename y to y' in t)[v/x]`?).

$$(\text{rename } y \text{ to } y' \text{ in } t)[v/x] = \begin{cases} \text{rename } y \text{ to } y' \text{ in } t & \text{if } x = y \quad \text{基础换名} \\ t[v/y'] & \text{if } x = y' \quad \text{如果更改的名字, 和替代名字重叠, 我们需要先换 } y', \text{ 在换 } y \\ \text{rename } y \text{ to } y' \text{ in } t[v/x] & \text{otherwise} \end{cases}$$

substitution => different situations ==