# Composition of Functions Algorithm f(g(x))

## *Combining Rules*

1. Write the f and g functions
2. Write the f(x) rule
3. In f(x), substitute g(x) for every x
4. Substitute the g(x) rule
5. Simplify

**If f(x) = 2x + 5 and g(x) = 3x + 1, find f{g(x)}**

$f(x) = 2x + 5$

$f(g(x)) = 2\ g(x) + 5$

$= 2\ (3x + 1) + 5$

$= 6x + 2 + 5$

$f(g(x)) = 6x + 7$

**If $t(x) = 4x$, $h(x) = 2x + 1$, find $h(t(x))$**

$$h(x) = 2x + 1$$

$$\begin{aligned} h(t(x)) &= 2(t(x)) + 1 \\ &= 2(4x) + 1 \\ &= 8x + 1 \end{aligned}$$

**We just found $h(t(x))$, let's find $t(h(x))$ and see.**

**Does $h(t(x)) = t(h(x))$?**

$$t(x) = 4x$$

$$\begin{aligned} t(h(x)) &= 4\,(h(x)) \\ &= 4(2x + 1) \\ &= 8x + 4 \end{aligned}$$

**We can see $h(t(x)) \neq t(h(x))$**