Function Composition

Example I:

$$f(x) = 3x \qquad g(x) = x+2$$

① $f(g(4))$

$g(4) = 4+2 = 6 \rightarrow f(6) = 3 \cdot 6 = \boxed{18}$

② $g(f(4))$

$f(4) = 3 \cdot 4 = 12 \rightarrow g(12) = 12 + 2 = \boxed{14}$

Example II:

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

① $f(g(x))$

$f(g(x)) = f(x+5) = 2 \cdot (x+5) = \boxed{2x+10}$

② $g(f(x))$

$g(f(x)) = g(2x) = \boxed{2x+5}$

Composition

Notation: $f(g(x))$ is $(f \circ g)(x)$

On your own

(I) $f(x) = x^2$ $g(x) = 2x$

$f(g(3)) = 36$

$(f \circ g)(x) = (2x)^2 = 4x^2$

$(f \circ g)(x=3) = 4 \cdot 3^2 = 36$ ✓

$g(f(3)) = 2 \cdot 9 = 18$

$(g \circ f)(x) = 2x^2$ $(g \circ f)(x=3) = 2 \cdot 9 = 18$ ✓

(II) $f(x) = 4x$ $g(x) = x+3$ $h(x) = |x+2|$

$(f \circ g)(x)$

$(g \circ f)(x)$

$(g \circ h)(x)$

$(h \circ g)(x)$