7.7 Operations with Functions Day 2

I. Simplifying Composition of Functions

Ex1) $f(x) = x + 3$ $g(x) = x^2 + x - 1$ Find $(f \circ g)x$ and $(g \circ f)x$.

$fog(x) = f(g(x))$
$= f(x^2+x-1)$
$= x^2+x-1+3$
$\boxed{fog = x^2+x+2}$

$gof(x) = g(f(x))$
$= g(x+3)$
$= (x+3)^2 + (x+3) - 1$
$= x^2+6x+9+x+3-1$
$= \boxed{x^2+7x+11}$

Evaluate if $x = 2$.

$= fog(2)$
$= 2^2+2+2$
$= \boxed{8}$

$gof(2) = 2^2+7(2)+11$
$= \boxed{29}$

Ex2) $f(x) = 3x^2 - x + 4$ $g(x) = 2x - 1$ $h(x) = x^2 - 3$

$goh(x) = g(h(x))$
$= g(x^2-3)$
$= 2(x^2-3)-1$
$= 2x^2-6-1$
$\boxed{goh(x) = 2x^2-7}$

$h(g(x)) =$
$h(2x-1) = (2x-1)^2-3 = 4x^2-4x+1-3$
$= \boxed{4x^2-4x-2}$

Plug 4 into
$4(4)^2-4(4)-2$
$64-16-2$
46

Evaluate $x = -2$

$g(4) = 2(4)-1 = 7$
$g(-1) = 2(-1)-1 = -3$

A. $f(g(-1)) = f(-3) = 3(-3)^2-(-3)+4 = 34$

B. $h(g(4)) = h(7) = 7^2-3 = 46$ or

C. $(f \circ (h \circ g))(2) = f(h(g(2))) = f(h(3)) = f(6) = 3(6)^2-6+4$
$= \boxed{106}$

$g(2) = 2 \cdot 2 - 1$
$= 3$

$3^2-3 = 6$

#30 $g(h(x)) = g(-3x+1) = -5(-3x+1)$
$= \boxed{15x-5}$

$g(x) = -5x$
$h(x) = -3x+1$

$h(g(x)) = h(-5x) = -3(-5x)+1 = \boxed{15x+1}$

Ex3) Tracy has $100 deducted from every paycheck for retirement before taxes are applied, which reduces her taxable income. Her state income tax rate is 4%. If Tracy earns $1500 every pay period, find the difference in her net income if she has the retirement deduction before or after state taxes.